GAS JOURNAL

LIGHT ⁘ HEAT ⁘ POWER ⁘ BYE-PRODUCTS

[Founded in 1849 as the "Journal of Gas Lighting."]

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Telephone: Central 6055. —— Telegrams: "GASKING, FLEET, LONDON."

VOL. CLXXIX., No. 3356.] WEDNESDAY, SEPTEMBER 14, 1927. [79TH YEAR.

EDITORIAL NOTES.

A Critical "Memorial Lecture."

SCIENTIFIC control in all things and in all places is a fine ideal. Probably it is correct; but we should feel that at times it might become somewhat monotonous, as monotonous as the military precision of doing many things which we used to encounter on our occasional visits to Germany before the war. We are advocates of scientific control in manufacturing and business affairs; but we like it to be mixed here and there with a little freedom, so as to feel that there is a salutary amount of latitude in it, and not too much tight lacing, which sometimes impedes movement. The "William Young Memorial Lecture" delivered at the annual meeting of the North British Association of Gas Managers was in the hands of Dr. E. W. Smith; and he appeared before the members as an idealist in the matter of scientific control—critical of the doings of the gas industry; but, as he confesses, not over-constructive. It is an excellent thing for an industry to receive criticism of its methods and acts; for criticism, even if the censor is not definitely constructive, has a value in that it induces the men concerned to examine the facts to see whether there is full justification for the reproof. To get them to do that is a step gained.

Dr. Smith was not over-enamoured of the title given to the lecture—viz., "The Economics of Scientific Control in the Production of Town Gas." He thinks that the word "economics" should have been "value;" and we think that in the use of the words "in the production of town gas," there is a limitation beyond which the lecturer strayed with an abandonment that sent control to the four winds. The deliverance, in fact, deals with the application of scientific control to every part of the work of the gas industry. "Scientific control" is not confined to the chemical and physical matters involved in gas production. There is often a too narrow conception, as the lecturer points out, as to what is meant by the term "scientific." The functions of the clerical, sales, and other departments should be carried out in an appropriately scientific manner just as much as the operations in the manufacturing and distributing departments. It is because William Young brought to bear upon his famous work (within the limits of the knowledge of his time) science, thought, and an analytical skill that led Dr. Smith to take the theme of scientific control for the "Memorial Lecture." Fifty-two years ago, William Young detected an awakening in the gas industry to the need for acquiring a greater knowledge of the chemical and physical laws upon which the gas-manufacturing process is based; and he suggested the infusion of more energy into this, accompanied by a higher scientific training for the work of the industry. But what he saw had comparatively slow growth until (say) within the past two decades. There has since been a real awakening, and genuine action and application; but practice and application are not by any means general in the industry. To help to fill the cavities where scientific control does not exist or is not fully applied is what Dr. Smith obviously had in mind in framing his lecture.

In some cases where scientific control does exist, it approaches, if it does not perfectly compass, the ideal found in the lecture. But the criticism and counsel may be divided between individual work in an undertaking and general work in which all undertakings have a common concern. Regarding both divisions, there must be an appreciation of the spirit in which the lecture was written, otherwise there is the risk that Dr. Smith may be regarded as a pedagogue, pedant, or carping critic, while, in fact, he merely stands as an observer who sees there is room for higher standards, and would like to see them applied. At the same time, we fear that the standards to which he aspires will not be realized in all undertakings for many a long year, if ever; while the general work which he would like to see taken in hand by the industry, under the direction of supervisory committees and research staffs (he has a great penchant for committees), would constitute such a load, unless taken in hand progressively, that it would stand in danger of never being brought to a state of fruition. We much prefer evolution through selection first of the most pressing work, with exploration carried through in a thoroughly trustworthy manner. There is much to be done; and we know how long research takes, and how oftentimes ill-success throws the investigators back again to the very beginning. However, a critic of the critic finds himself in the dilemma that he knows Dr. Smith's advocacy of higher scientific standards is right, and yet there is the feeling, engendered by what is practicable, that the lecturer is too ambitious and eager to realize his great ideal of how things should be, and how they ought to be attained. Reformation for the attainment of an ideal state must be governed by practical considerations.

Bearing in mind that Dr. Smith deals with the need for scientific control in all departments of a gas undertaking, we will in the main confine further comment to that side of the question with which he is most competent to deal—that is, the chemical and physical side, in gas production. There is much that is sound, and therefore acceptable, in what he has to say. A great deal of misconception exists as to what constitutes scientific control in a gas undertaking; and, in practice, there is much pretence in connection with it. Some managers seem to think that it is sufficient to employ someone who has had a chemical training, to carry out routine tests. The man appointed may have been chemically trained, but may not have the aptitude for applying his knowledge—any more than some managers have for giving full scope to an efficient chemist's training in the work of an undertaking, or for valuing and applying the results of his work. In speaking plainly on this subject, Dr. Smith does well. His criticisms and suggestions should be most valuable in the shaping of proper procedure in connection with

scientific control. As he shows, it is not an expensive thing when carried on in a really scientific manner. When, however, in discussing the splendid field the gas industry offers for scientific control and research, he incidentally expresses his "humble opinion that the gas industry could be made, in effect, into one big trust with great advantage to it and the community as a whole," we are a little mystified as to what is exactly in his mind, and so have to refrain from commenting on the point, inasmuch as any hypothesis regarding connotation may be wrong.

There is agreement with the lecturer in his views respecting the promotion of the industrial gas business, and especially where he contends that the selling of appliances by gas undertakings for industrial purposes should be looked upon as a means to an imposing end, and the appliances should not therefore be in themselves the objects of profit-making. In his judgment, it would pay headquarters to appoint a small commission to make a study of the whole subject both here and in America, with the view of taking full advantage of the enormous possibilities of the development of the industrial load; and, in association, it would also pay the industry to subsidize research into the industrial utilization of gas.

As to general research, Dr. Smith compliments the Institution of Gas Engineers and the National Gas Council on the work that is being carried on under their auspices; but he deplores the small amount of money that is expended on it. He is certain that the industry could afford to pay more for research, and that more research would, if properly organized, well repay the industry. We thoroughly agree with this, as with the view that the contractors for plant and appliances should in this matter be brought into close collaboration with the supply side. But the ambitious research programme the lecturer presents in this connection, with standing committees of "real" specialists, with chairmen and secretaries collaborating in the work, and assembling, dissecting, and evaluating all known information and current experience in connection with their special subject, while further scientific research is proceeding under their supervision, tempts one to the view that no simultaneous violent research rush into all the ramifications of our great industry would be as efficacious as would be the taking-up of the subjects in systematic order, according to their relative importance. Thoroughness is an essential in such work, and thoroughness is not attained in research by having too many irons in the fire at one time.

In this connection, we regret that Dr. Smith introduced any comparison between the expenditure on publicity and research in our industry. While a great believer in the work of the "B.C.G.A.," he says that he does not "feel there should be any further increase in the amounts expended on publicity and advertising *if* such increase is only possible at the expense of what should be done in connection with the development of research. The whole subject is worthy of the fullest inquiry." The lecturer is a great believer in the work of the "B.C.G.A.;" and therefore he will be inclined to consider our opinion as we have considered his. Publicity and research must in our industry be treated absolutely separately. They have no, or little, relation in their effects. Research is very valuable for development on the productive side; publicity, for imparting knowledge to the public, which leads to business maintenance and development. We are convinced—and we say this very deliberately—that to cripple in any way the work of the Association in connection with publicity and educational work, would be one of the most suicidal things for the gas industry to do to-day. Our rivals are full of energy, with a Government Department—the Electricity Commissioners—fostering their interests in every possible way, and with the newspapers constantly stimulating public interest in the Government scheme by the false proclamation that it will in due season deliver into their houses electrical energy for all purposes at ¼d. or ½d. per unit. At the same time, we want to see scientific research developed in the gas industry; but this should be, and must be, done by the gas industry finding the money for, and realizing the benefits from, it, altogether irrespective of the money spent in the promotion of the business itself. Politic thought and procedure must be intermingled with scientific control.

New Methods of Charging for Gas.

IT was a very proper thing for the North British Association of Gas Managers, at their annual meeting, to discuss the question of a change in our methods of charging for gas; and it would be equally appropriate if all associations connected with the gas industry were to do the same, in view of the forthcoming legislation which, it is hoped, will open the way for increasing the latitude of gas undertakings in this respect. The more the subject is discussed at the present time, the better prepared shall we be when statutory powers are available, which will enable an alteration to be made on terms that will distribute costs more equitably among consumers, and at the same time encourage them to make a more liberal application of gas—this with the knowledge that, while (assuming the adoption of a two-part tariff) their fixed charges remain the same, the increased use of gas under the secondary low charge per therm will automatically bring about a reduction of the average price of the therms used. The subject was introduced at the meeting by Mr. J. Campbell, of Dunfermline, and, in doing so, he referred to the reproduction in the "JOURNAL" of the contents of the manual on "Better Forms of Rates for Gas," which has been issued by the American Gas Association. He also described the two, three, and four part tariffs, as in operation in the United States. So far as consumers are concerned, we do not think they need be worried by tariffs constructed of three or four parts. In our opinion, it will be better only to confront them with a tariff of two parts, and thus simple of appreciation, irrespective of the manner in which the primary charge is constructed. But in its construction, it will be well to apply general principles, regarding which, it is hoped, in due season we shall be having some definite guidance from the Committee of the National Gas Council who have been considering the matter.

Mr. Campbell begins his paper by positively declaring: "The flat-rate system of charging for gas, though in "general use, has become unsatisfactory under present-"day conditions; and it would appear to be absolutely "necessary that some other system should be adopted by "the industry." We agree. But later on, speaking of the American two, three, and four part gas tariffs, he says: "It appears to me that in this country we would "have strenuous opposition to such charges, and that the "better policy would be to have what might be termed a "'concealed service charge' in a higher rate per 1000 c.ft. "for (say) the first 20,000 c.ft. or other quantity con-"sumed per annum. Of course, this means raising the "rate to a large number of consumers; and, therefore, "the most appropriate time to make such a change would "be when gas rates are being reduced." While we are whole-heartedly with Mr. Campbell in his opinion that a new system of charging should be adopted by the gas industry, we cannot concur with his view that there would be strenuous opposition to (say) a two-part tariff, any more than there was to the therm system when it was introduced. Electricity undertakings (it is highly important to bear in mind the need of equal facilities between competitors when considering the question of a change in tariffs) have found the primary fixed charge and secondary small charge per unit very popular; and the telephone system of charging appears to be perfectly well understood and appreciated by the users. Mr. Campbell fears that the consumers would look upon the change in system as only another method of extracting money; and he refers to the publicity campaigns which have been found necessary in America in making the change, and also to the publicity work which the Post Office had to do before they altered their system of charging. He also agrees that there is no objection on the part of telephone users to this method of charge, though there were complaints at first from those who had previously had the service below cost. We are not frightened. But what does it all amount to—simply that the system will need explanation to the gas consumers, many of whom are both telephone and electricity users. We of the gas industry are really in a fortunate position in not having to introduce something which is novel to the country. The real spade

work has already been accomplished by the Post Office and the electricity industry. It would ill-become a great trading industry such as that of gas supply if it hesitated to make a change which it knows is logically right, and of great commercial value in these competitive times, because of the educational work which it involved, and which work would—there is confidence—ultimately be to the advantage of the whole industry.

Then as to a "concealed service charge" in a higher rate per 1000 c.ft. or per therm. We think this would have an effect directly contrary to that which a low secondary charge is intended to have—that is, to promote a larger consumption through one service-pipe and meter. As a matter of fact, Mr. Campbell himself shows that his method of a "concealed service charge" in the price for a consumption of (say) 20,000 c.ft. would mean that the price would have to be raised; and so he suggests that the proper time for the change to be made would be when prices were going to be reduced. This, we incline to think, would immediately—in the circumstances ruling at Dunfermline and many other places—suggest to the consumers whose consumption it is most desirable to enlarge that there was some hocus-pocus about a "reduction" which was not particularly visible. Moreover, it can readily be seen that this would complicate the making-out of the accounts of the ordinary consumers, and increase the work of the clerical staff—inasmuch as the first 20,000 c.ft. would be charged at one price, and subsequent consumption at another, which would mean two separate calculations and items in the accounts.

A particularly interesting part of Mr. Campbell's paper is where he deals with the investigation made in Dunfermline of consumers' consumptions, which corroborates the frequently made contention as to the inequitable distribution under the flat-rate system of service charges, apart from those which vary in connection with gas production and distribution, and also as to a proportion of the consumers being unprofitable to the detriment of the profitable ones. His figures are well worth looking into. Probably they will suggest that a similar survey should be made by other gas managers; for, as a rule, those who have made such an investigation have been very surprised to find they have so much unprofitable business on their books. It is sometimes submitted by those who have not made a critical examination of the kind, that the small consumers are poor. Those who say this are sympathetically inclined, although they would not be prepared to admit that a gas undertaking is a philanthropic institution. But a little thought should give them the assurance that a substantial part of the unprofitable consumers are not necessarily poor; consideration alone of the consumption results from the prepayment meter system should disabuse their minds of the idea. A survey such as that which has been made at Dunfermline shows that—and this is the experience of our American friends—the small and unprofitable consumers are often the occupants of offices, banks, shops, &c.

Mr. Campbell also places his finger on a weakness of the discount system when based on money values. We submit that discounts should always be based on volume; for the simple reason that then, with variations in price, there is equality between consumers, whereas, when circumstances necessitate the raising of the price, many consumers (with the money payment as the basis for discount) qualify for it or for a higher discount, although their consumption may not have increased. It is due to this and other irregularities in conditions that induced Mr. Campbell to suggest giving all consumers exactly the same terms, and making the price dependent upon quantitative zones of consumption. With this in view, he devised a scale of charges (which has not yet been accepted by his Committee) which offers substantial concessions of price as the stages in volumetric consumption advance. The scale is as follows:

	Per 1000 C.Ft. s.	d.
For consumption up to 24,000 c.ft. per annum	3	2
For the next . . . 76,000 " " "	2	6
" " " . . . 400,000 " " "	2	1
" " " . . . 500,000 " " "	1	10
Balance at	1	8

In these figures there is a "concealed" charge of 4d. per 1000 c.ft., which, in the case of those using 24,000 c.ft., amounts to 8s. per consumer per annum, which is acknowledged to be inadequate as a service charge, but is a step in the right direction. The same charge applies to the largest consumers. The advantage of this is that the consumer who uses 24,000 c.ft. of gas at 3s. 2d. per 1000 c.ft., and who decides to instal a gas fire or fires, knows that he will get the gas for that purpose at the 2s. 6d. charge for the next consumption zone.

The prices per 1000 c.ft. for the higher consumptions are such that perhaps there is fair ground for Mr. Campbell's view that there need be no differential rate for industrial purposes, and no discounts. To establish an irrevocable rule in this regard, however, would not be satisfactory in the case of all gas undertakings. We know of instances of large industrial consumption which would be lost unless discounts were allowed—the consumers being not only insistent on the point of a discount, but gratified over the idea of being able to deduct something from the account as rendered. For an undertaking it is not always an easy matter to determine practice in this regard, and to adhere resolutely to it. It is sometimes a case of Hobson's Choice. Of course, conditions vary between towns, and different practices have to be adopted.

We cannot say, although Mr. Campbell's proposal is one way of taking a step in the right direction, that it attracts us as a means of encouraging consumption in the same way that a two-part tariff would do, with a secondary low rate per therm. It is the secondary low rate which will have a big influence among consumers generally. However, the author does not submit that any hard-and-fast rules can be laid down in this matter; and he shows that he has an open mind regarding it.

Gas Blending for Small Works.

THE second paper read at the Annual Meeting of the North British Association of Gas Managers was on the subject of "Gas Blending." It was by Mr. Robert Sturrock, of Ardrossan, and will be found especially useful to engineers of small works. It deals with the problem of supplying gas of a calorific value suitable to the requirements of to-day, and suggests how this can be cheaply effected by works of modest magnitude. Ardrossan has an annual gas output of 44 million c.ft.; and its coal-carbonizing plant consists of horizontal retorts. When Mr. Sturrock was faced with the question of increasing the productive capacity of the works—combined with consideration as to the thermal quality of the gas which would best meet the needs of the area, while maintaining a minimum pressure of 30-10ths at the extreme end of the district—he resolved upon a calorific value of 440-450 B.Th.U. per c.ft. Incidentally, he expresses the opinion that a calorimeter is an absolute necessity on all works whatever the size. We agree with him; for it is one of the best means of keeping guard over economy and efficiency, and maintaining the satisfaction of the consumers by ensuring a level calorific line. At the same time, the importance in utilization of constant specific gravity should not be overlooked. The investment in a calorimeter for the protection of efficiency and economy in manufacture, and the satisfaction of the consumer, is profitable for a small undertaking as for one of greater size—in fact, the author is convinced that, if such an instrument is properly applied, it will in a short period, through its guiding indications, more than clear the initial expenditure upon it. However, in deciding how to reduce his coal-gas production to the required 440-450 B.Th.U. level, Mr. Sturrock properly eschewed overpulling, with its damaging results; and he also decided not to dabble in introducing steam into his horizontal retorts, in which process other engineers have failed to find what they sought, owing to the internal conditions of the horizontal retort not being favourable. Therefore, he resolved, after investigation, to adopt the "Simplex" C.W.G. plant, with the "Sydenham" grate to prevent clinkering troubles. From his experience, the author pays good tribute to the working

of this. In the two years' operation of the plant, there have been no signs of clinkering in the generator; and when inspection was made a couple of months ago, it was found that the inside brickwork was in as good condition as on the day operations began. To say the least, this is remarkable when consideration is given to the varying qualities of coke which were passed through it during the period of the coal stoppage. There is one point about Mr. Sturrock's method of working the plant which may not commend itself to other engineers. The cycle on which he operates is six minutes' "blow" and twenty minutes' "run;" but, in his view, the quality of the blue gas produced, and the effect the cycle has on labour charges per 1000 c.ft. of gas, are sufficient justification for his procedure. There can be little ground for criticism of the practice in face of the experience and the analyses of the gas at different stages of the run.

The second part of the paper treats of the advantages which are derived by the undertaking from the method of working in combination horizontal retorts and the "Simplex" plant. The value of being able to produce gas of 450 B.Th.U. or thereabouts, with a low percentage of inerts, is one point. Regarding the inerts, it will be seen that the total carbon dioxide, oxygen, and nitrogen in the straight coal gas is 7·3 p.ct., whereas in the mixed gas as produced it is 14·8 p.ct. The second advantage is the saving in annual repairs and renewals to retorts; but there is no mention of the discount to be made for the maintenance of the "Simplex" plant, though, as the paper indicates, this must have been *nil* during the first two years' operation, which, of course, will not always be the case. Then there is the saving in labour charges, including less coal handling. Further, the plant enables cheaper gas to be made, notwithstanding that lower capital costs are involved in its installation. Supplementing these benefits is the fact that the undertaking is in the position of having no coke available for sale outside the local requirements, and good prices are obtained. From this it is seen that there are collateral advantages to which the author does not in definite terms ascribe a money value, although it is obvious that there are in them financial gains which must influence the annual accounts.

In passing, the author refers to the advantages of blending coal; and then the results of the working are presented. The average quantity of coke used per 1000 c.ft. of blue gas produced is 45 lbs.; and the average production is approximately 50,000 c.ft. per ton. The calorific value of the blue gas fifteen minutes after the run has commenced is 292 B.Th.U. (gross), which gives 146 therms per ton of coke. The gross calorific value of the coal gas is 561 B.Th.U.; so that, we take it, Mr. Sturrock mixes his blue water gas with the coal gas in the proportion of 40 to 60, seeing that the gross calorific value of the mixed gas is 446 B.Th.U. Of the mixed gas, 17,505 c.ft. (or 78·1 therms) are produced per ton of coal, with 4·8 cwt. of coke available for sale. These are figures which should be taken rather than the ones which Mr. Sturrock incorporates for 1926, when gas plants were not in a position to do their best, dealing as they were with coal of abnormal condition and quality. At the end of the paper, information regarding costs is included. On the basis of a month's working prior to the installation of water gas, the cost of the straight coal gas is given as 2s. 1d. per 1000 c.ft. into the holder. After the introduction of water gas, the cost was reduced to 1s. 6d. per 1000 c.ft. into the holder, upon which the author remarks: "The comparison shows a saving in the cost "of production of 7d. per 1000 c.ft. into the holder." We would point out, however, that the 1000 c.ft. for the mixed gas is not quite the same as 1000 c.ft. of straight coal gas. Making comparison on the therm basis, and taking 5·61 therms as representing 1000 c.ft. of straight coal gas, and 4·46 therms as representing 1000 c.ft. of the mixed gas, it will be found that the saving is actually in the neighbourhood of ¼d. per therm, which does not work-out to 7d. per 1000 c.ft. If, however, other advantages of the working, which are not included under the heading of costs in the paper, are taken into account, the saving per therm would be increased in a satisfactory manner. No economies in these days can be neglected.

Explanation of Bradford's Past Meter Policy.

WE are inclined to think that the past policy of the Bradford Corporation Gas Department regarding the provision of meters has not been understood by those who have criticized it most; and perhaps, at this stage, a short explanation should be made, in order that a wrong idea may not gain ground in the gas profession. Owing to the custom of the landlord of cottage property being held responsible to the Corporation for all gas consumed by his tenants, the number of houses without a gas supply has always been insignificant, compared with that in other towns. Consequently, there has been no necessity for the introduction of prepayment meters until the last few years, when landlords have, in some cases, refused to accept the liability any longer. Many of the tenants have been unable or unwilling to give security; and (as will be seen by the figures in the report by Mr. Ernest J. Sutcliffe, as published last week), for this reason, 319 are now cut-off—a decrease of 182 on the position two years ago. The item of supplies being cut-off by owners' orders (due in practically every case to some dispute between the owner and the tenant) is 504—a reduction of 286 on the 1925 figures. In 200 cases the tenants are without gas because the landlords refuse to put the meters into good working order. These cases, totalling 1023, are really the only ones which might have had a gas supply had prepayment meters been used by the Corporation.

If a comparison with other towns had been made before the gas industry generally adopted prepayment meters—say, 40 years ago—there is no doubt that Bradford would have had a greater number of consumers for its population than any other town in the country. Even as matters now stand, it is ahead of some of its neighbours in this regard. According to the 1921 census—the latest available—the population of Leeds (Bradford's next-door neighbour) was 458,320, and Bradford 285,979. For the same year (1921-2), the Board of Trade Returns relating to statutory gas undertakings gave the number of consumers for Leeds as 119,942 (63,393 ordinary, and 56,549 prepayment) and for Bradford 83,498 (79,588 ordinary, and 3910 prepayment). Taking the ratio Population ÷ Consumers, it will be seen that Leeds, with 47·1 p.ct. of prepayment meters, had one consumer to 3·8 of the population; while Bradford, with only 4·7 p.ct. of prepayment meters, had one consumer for every 3·4 of the population. It is obvious that it is only the landlord's recent change of front that has rendered the adoption of the prepayment meter a necessity, and not any antiquated policy or lack of initiative during recent years. In other words, Bradford forged ahead many years ago when other towns were standing waiting for business; and, when the prepayment meter arrived, there was no scope for it there, while towns which had been standing at ease took it up readily, and made headway. But time and requirements change; and what is happening at Bradford is simply that the time has arrived when circumstances call for a revision of policy.

Unsafe Road Surfaces—Inquiry Urged.

MOTORISTS are now taking a very live interest in the question of road surfaces; and there can be no astonishment at this when one considers the number of wet days we have in this country, and the appalling list of fatalities which appears in the newspapers week by week, many of which are due to skidding owing to the character of the road surfaces. They are now asking themselves: "Why should we be exposed to this sort of thing when "it is well-known that materials can be used for road "making and surface dressing which are exempt from "the treacherous conditions which now exist over large "stretches of roads throughout the country, and this "largely in the interests of an imported product?" In its issue for Sept. 6, "The Motor" contains, on an early page, an article headed "Treacherous Road Surfaces," and on a later page an editorial article, which is headed with the question, "Why Dangerous Roads?" Why, indeed? Accompanying the first article is a photograph of a stretch of the Eaton-Socon to Wansford section of the Great North Road soon after it was opened; and by

the side of the road is a notice board bearing in large letters the words "Beware Skidding When Wet." It is also mentioned that a new section of road between Hatfield and Welwyn is even more dangerous, and at parts danger signs are already erected. It is time that motorists took very strong action in their own defence. What surprises our contemporary is that, although there is so much evidence of the great danger to those who use these highly polished roads, particularly in wet weather, the authorities responsible for their making continue in their wrong-doing. The question appears in the heading to the first article, "Who is responsible?" In the text, the inquiry is made as to what further proof the road authorities want other than disaster and death to convince them that the methods of road making and road dressing that are now being adopted so generally are wrong. "Have not they "had sufficient evidence that the Great West Road and "the Southend Road are not, in the first place, economical "roads to lay and maintain, and that they are not safe "roads for the travelling public to use." The pertinent question is put as to whether road authorities are so far committed to the use of certain road materials that they cannot change over to something safer? In the editorial article emphasis is laid upon the gravity of the responsibility which rests upon those who have to decide upon methods of modern road construction and upon the materials used in their maintenance; and very definitely the opinion is expressed that the whole subject should be submitted to exhaustive public inquiry. Our contemporary also states that its criticisms have hitherto been met by official assurances to the effect that the question is being studied in all its bearings, in the hope that experiments will result eventually in safer roads being provided. But it says that it cannot be expected for ever to be satisfied with promises that are never redeemed; and thus it is the opinion is held that an independent tribunal should undertake a thorough investigation. The gas industry, we are sure, would welcome this, but it is for the users of the roads to urge the matter forward.

Training Gas Students in Power Generation.

In the United States, it is a common condition for the gas and electric supplies to be in the hands of one company, and therefore one administration. In this country, that is the exception, and not the rule; and the electricity industry here have done their best to maintain this state, on the ground that they have no faith in men who have been trained in the gas industry giving free rein to electricity to develop to the utmost extent. Yet, when it suits them, they quote the greater consumption of electricity per head of the population in the States as compared with that in this country, conveniently overlooking the fact that the two supplies are in the States so largely under one direction. Moreover, the instances we have in this country of the dual supplies being under one ownership and management demonstrate that electricity in such circumstances does develop side by side with the gas supply. And no one but a nincompoop would suggest that business men would invest capital in electricity supply for the mere purpose of doing a good turn to the gas supply; for using capital solely with the object of damming back the demand for electricity would recoil upon the gas business, by imposing upon it a heavy burden in the nature of capital charges and upkeep, which would not be good for the price of gas, and the development of its use. Commonsense infused into expressed opinions is an admirable thing in preserving a reputation for sound judgment.

It will have been seen from a short report in the last issue of the "JOURNAL" that our friends in America are, with their training of men in the theory and practice of fuel and gas engineering, combining power generation, and in very practical fashion. The manufacture of gas and the release of the valuable properties of coal, and the utilization of the heat properties of the gas and the solid residue, are all so bound-up together that the generation of power follows on in perfectly natural sequence. Thus the linking-up of power generation as part of the training of students in Fuel and Gas Engineering at the Massachusetts Institute of Technology; and another extension is into oil refining. There is no question that in America they are training their students not only in conformity with present-day need, but with an eye to the future—in other words, study is not limited to existing practices, but is carried on to others which are of a certainty developing. There is nothing like being prepared. They are also great believers in what is called "field work" for students. That is to say, while the theoretical side is studied at the Institute, arrangements are made for the students getting out into works for plant and test studies in association with everyday technical and commercial operation. This is highly valuable. The latest arrangements will give the students in fuel and gas engineering the privilege of doing "field work" at the Edgar station of the Edison Company, which is the newest and most modernly equipped of central stations. It may be said that power generation is not necessary for fuel and gas engineers in this country. We are not of that opinion. The nature of the mechanized operations of most gas undertakings calls for electric driving, using private generating plants; and therefore an electrical training for gas engineers is advisable from that point of view, while not being by any means amiss as an aid in directing the commercial work of the gas undertaking. Our friends in America regard the development of the training of fuel and gas engineers in electrical work and oil refining as a logical one.

Open Fellowship.

It will be seen by an advertisement from the Leeds University published to-day that applications are invited (up to Sept. 30) for an Open Fellowship (£200 per annum), established by the Institution of Gas Engineers, for the prosecution of post-graduate research in Gas Chemistry.

A Chief for Manchester.

The Manchester City Council have accepted a recommendation that a Chief Engineer and General Manager for the Gas Department be appointed.

Coal Output.

During the week ended Aug. 20, the output of coal from British mines was 4,888,100 tons; the wage earners employed in the realization of that quantity being 984,400. In the previous week, the production amounted to 4,952,100 tons, with the wage earners numbering 981,500.

Housing Enterprise.

The latest official figures regarding the erection of houses under the Housing Subsidy Acts should gladden the hearts of those responsible for such an essential service as gas supply. Under the Government housing policy, in the year ended March 31, 1925, the number of houses built was 137,000; in 1926, 173,000; and in 1927, 217,000—a total for the three years of 527,000. The Minister of Health has stated that the rate of progress this year bids fair to rival the phenomenal advance of last year.

Taxation Outlook.

Industrialists will have derived satisfaction from the prediction which the Chancellor of the Exchequer made at a garden fête at Floors Castle last Saturday week, that we shall come through the consequences of the industrial trouble of last year without having to re-impose any of the £40,000,000 of direct taxation remitted by the present Government in 1925, or any of the £20,000,000 of indirect taxation remitted by his predecessor (Mr. Snowdon) in 1924. There is also every expectation that we shall be able to provide every penny of our debts under the sinking fund—a full total of £65,000,000 which was set apart for that purpose last year. We hope Mr. Churchill's anticipations will prove correct, and likewise that he was not taking too optimistic a view when he said that British industry, after the industrial upheaval of last year, is once more in full swing, and the work of repairing damages has already made appreciable headway. In view of this, we should like to see an improvement in the unemployment returns.

Unemployment.

The unemployment figures continue to vacillate a little above and below the one million mark. In the week ended Aug. 29, the total number of persons on the registers of the employment exchanges was 1,049,300, compared with 1,044,400 in the week ended Aug. 22. However, the return for the week ended Aug. 29 was better by 500,459 than for the corresponding one of last year, when the figures were affected by the dispute in the coal-mining industry. Of the total, 690,400 were persons wholly unemployed (554,300 being men), 295,900 were temporarily stopped, and 63,000 are normally casual workers.

Britain's Health.

The gas industry prides itself that it has made a substantial contribution through its service to the betterment of the health of the nation. The use of gas and coke for heating has been of immense value in producing cleaner atmospheric conditions; and the convenience of gas as a cooking agent has done much to promote the proper preparation of food for the community—particularly in the case of the poorer section of our social constitution. In his annual report, Sir George Newman, Chief Medical Officer of the Ministry of Health, points out that it is important to remember that personal health is not an accomplishment, but a growth—a growth which depends upon the nature of the individual, his constitution, and its sound nurture. Nature and nurture lie at the foundation of all true growth and all true health, and they are mutually inter-related. He also tells us that, in spite of an enormous increase of population without increase of home territory, the total death-rate and the infant mortality rate of the nation have been halved within four generations. The mortality of childhood is one-third of what it was eighty years ago. The "expectation" of life for a child born in this country to-day is not less than seventeen years longer than it was for a child born in 1846. This is highly satisfactory; but our electrical friends, viewing the enormous use of gas in our homes, think the health of the nation should be on the down grade.

Trade Unionists and Communists.

The leaders of the trade union movement, at the meeting of the Trade Union Congress in Edinburgh last week, gave abundant evidence that they intend to be masters in their own house, and will not brook any dictation from the Communists or Moscow, or from anyone here whose actions are controlled by the latter. The All-Russia Council of Trade Unions regard themselves as a dominating force in the world's labour movement; true Britishers in the labour world have had enough of their crude dictation and vulgar insults. On the recommendation of the General Council of the Trade Union Congress, a resolution was passed, by 2,551,000 votes against 620,000, to the effect that no useful purpose could be served by continuing negotiations with the All-Russia Council so long as their present attitude and policy are maintained.

A New Note.

An equally important thing for this country is that, at the Congress this year, a totally new note was struck. The General Council must forgive people for regarding their past policy as a highly militant one, when the proceedings at former congresses are considered, with their crowning by the general strike in May of last year. Most of the labour leaders hold that the hands of the political party now in power are against the trade union movement. The Trade Disputes Act is said to be evidence of this; and, in their view, it should be immediately abolished. It is averred that the best thing possible would be for the present Government to resign, so that a Labour Government might have a chance to undo the beneficent work Parliament has latterly done, which will be of inestimable value to the trade unions and their members in the time to come. But apart from that attitude, the proceedings last week suggest that the trade union leaders are now fully persuaded that the best interests of their members will be served by the development of trade union policy in the direction of promoting and maintaining peace, with the view of assisting industries to become as effective as possible. That assuredly is the best road to foster increase and constancy in employment for trade union members. The President (Mr. George Hicks), the General Secretary (Mr. Walter Citrine), and all the men whom we recognize as true leaders, show that they are, after last year's performances, taking a new outlook, and are preparing for a movement to encourage more peaceful conditions in the industries.

What the President Said.

Mr. Hicks well summed-up the position in his address when he said: "Much fuller use can be made of the machinery for joint consultation between employers and employed. It is more than doubtful whether we have seen the fullest possible development of the machinery for joint consultation in particular industries; and practically nothing has been done to establish effective machinery of joint conference between the representative organizations entitled to speak for industry as a whole." He also expressed the hope that such discussions would show "how far, and upon what terms, co-operation is possible in a common endeavour to improve the efficiency of industry, and to raise the workers' standard of life. The President also made the significant suggestion that "we should not be deterred by allegations that, in entering into such discussions, we are surrendering some essential principle of trade unionism." The President had much to say as to the wickedness of the capitalists and of the "idle rich;" but attacks of this kind are commonplace at these meetings, and are altogether of minor order when compared with the statements to which quotation is given above, and which promise so much for the future.

PERSONAL.

Mr. JOHN E. DAW has been elected Chairman of the Exeter Gas Light and Coke Company, in succession to the late Mr. C. Hardy Harris.

At a recent meeting of the Directors of the Alcester Gas Company, Mr. W. H. THOMAS, Works Manager, was presented with a handsome gold watch, in commemoration of 25 years' faithful service in that capacity. The Chairman of the Company (Mr. Geo. Haines) expressed the hope that for many years to come the Company would have the benefit of Mr. Thomas's services.

OBITUARY.

The death occurred at East Cowes on Saturday last of Mr. ROBERT FISH, retired Gas Engineer, who for more than half-a-century had been a member of the Institution of Gas Engineers. He was elected to membership in 1885, and was a member till the time of his death. After being Engineer and Manager of the Hornsey Gas Company for ten years, he had charge of the municipal lighting at Bucharest; and for his services in maintaining public lighting in exceptional difficulties during the Russo-Turkish war, he was decorated by King Charles of Roumania with the Order of the Knight of Star of Roumania. He was Manager of the East Cowes Gas-Works for about thirty years, and took an active part in public affairs. Mr. Fish was 90 years old.

FORTHCOMING ENGAGEMENTS.

[*Secretaries of Gas and Kindred Organisations are asked to assist in making this diary of events as complete and useful as possible by sending the earliest intimation of all meetings.*]

Sept. 16.—GAS SALESMEN'S CIRCLES.—Annual meeting in London.

Sept. 22.—WALES AND MONMOUTHSHIRE DISTRICT INSTITUTION OF GAS ENGINEERS AND MANAGERS.—Meeting at Porthcawl.

Sept. 23.—SOUTHERN ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Visit to Hollacombe Works of the Torquay and Paignton Gas Company.

Sept. 30.—EASTERN COUNTIES GAS MANAGERS' ASSOCIATION.—Annual meeting at Cambridge.

Oct. 3-5.—BRITISH COMMERCIAL GAS ASSOCIATION.—Sixteenth annual general meeting and conference at Southampton.

Oct. 27.—MIDLAND ASSOCIATION OF GAS ENGINEERS AND MANAGERS.—Autumn general meeting, Grand Hotel, Birmingham, at 2.30.

Nov. 17.—SOCIETY OF BRITISH GAS INDUSTRIES.—Autumn General Meeting at the Hotel Cecil.

INSTITUTION OF GAS ENGINEERS.

Oct. 10.—Emergency Committee.

Oct. 10.—Finance Committee.

Nov. 15.—Public Works, Roads, and Transport Congress. Morning—Joint Session with Incorporated Municipal Electrical Association for discussion on "Street Lighting." Afternoon—Institution Session for discussion of "How the Gas Industry Can Assist Smoke Abatement."

DEGREE FOR SIR CHARLES PARSONS.

Doctor of Laws in the University of Leeds.

At a special Congregation of Leeds University on Sept. 6, held for the purpose of conferring degrees upon a few of the most distinguished members of the British Association attending the meeting in that city, Prof. J. W. Cobb presented the Hon. Sir Charles Algernon Parsons, O.M., K.C.B., F.R.S., for the degree of Doctor of Laws, *honoris causa*.

Prof. Cobb, in doing so, said: To bring the methods and results of scientific investigation into the service of the community through industrial application is one of the chief ends which this University has set before it; and no name could represent with greater distinction the attainment of that ambition in full measure than that of Sir Charles Parsons. He has been fortunate in seeing one child of his brain reach full and imposing stature in his own time, as he has watched the steam turbine take unquestioned first place among the prime movers known to engineering science, serving to open-up the way to a much more general and efficient utilization of mechanical and electrical power. Grasp of scientific principles and insight into their consequences, along with a rare capacity for right choice in experiment and design, have been the mark of this and other achievements of his genius; and they have been combined with a breadth of outlook which has increased their value and widened the sphere of his usefulness. His active interest in the British Association has displayed itself in many ways, including generous financial support; and he has filled the Presidential Chair. Other societies have benefited by his guidance in the same high office; and he has controlled large industrial enterprises, including one for optical work which links to Lord Rosse and continues a family tradition. University education in Newcastle has found in him a warm supporter. In the spirit of adventure, he has summoned the forces of crystallization to the making of diamonds, and contemplated breaking the earth's crust for the harnessing of the vagrant energies of the underworld. Recognition has been forthcoming of his many scientific and public services in the Honorary Fellowship of his college at Cambridge, the Fellowship of the Royal Society, the Knight Commandership of the Bath, and in the membership of the Order of Merit, into which distinguished company he enters as the first engineer. It was to Leeds that he came for works training in early years; to Yorkshire for his wife. To Leeds again we welcome him, and do him what honour we may.

SIR EDWARD BROTHERTON'S MUNIFICENCE.

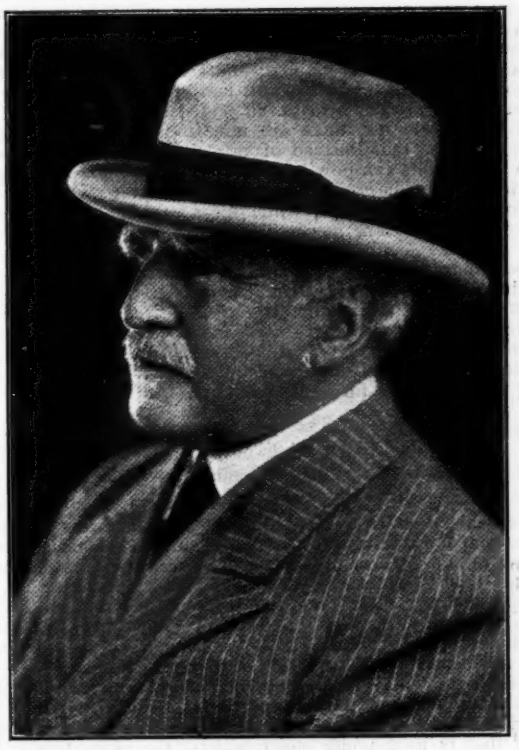
Great Gift to Leeds University.

When an offer of £100,000 to defray the cost of a new library in the Leeds University reconstruction scheme was conveyed in a letter to the Vice-Chancellor (Dr. J. B. Baillie), the writer asked that for the time being he should remain anonymous. Subsequently it was announced that the donor was Colonel Sir Edward Allen Brotherton, Bart., who has always shown the keenest interest in the work of Leeds University and in education generally. He is a life member of the University Court, and is an honorary LL.D. of the University.

Head of the well-known firm of chemical manufacturers, Sir Edward has been a generous donor to the institutions of the city, having previously given £20,000 to the University for the development of bacteriological study and research. He was Lord Mayor of Leeds in 1914, and was largely responsible for the formation of the Leeds Pals' Battalion, which he equipped at his own expense. In 1902-1903 he was Mayor of Wakefield, and represented the city in Parliament from 1902 to 1910, and again from 1918 to 1922.

THE FORMAL ANNOUNCEMENT.

The name of the giver was formally announced at the close of a Congregation of the University, held in the Great Hall for the conferment of degrees *honoris causa*, when the Duke of Devonshire (Chancellor) said: "I am permitted to make the following announcement, which, I am sure, will be of the greatest interest to this Congregation and the community of Yorkshire generally. The name of the donor of the gift of £100,000 to defray the cost of the new library building is Sir Edward Allen Brotherton. I would take this opportunity of conveying on behalf of the University our profound appreciation of this magnificent benefaction, which will for all time give distinction and efficiency to the University of Leeds. The library, when erected, will be permanently associated with the name of Sir Edward Allen Brotherton."



Colonel Sir EDWARD A. BROTHERTON, Bart., LL.D., Chairman of Brotherton & Co., Ltd.

CONFERENCE ON ENGINEERING MATERIALS, BERLIN.

The preparations for the Conference on Engineering Materials, which is to take place from Oct. 22 to Nov. 13 next, are already far advanced. The programme of papers contains about 200 lectures to be read by scientists and practical engineers. Foreign scientists will be the speakers, especially in some series of lectures to be held on Oct. 31. While these papers, which are to be read at the Technical University of Charlottenburg, are intended chiefly for engineers, an exhibition of engineering materials, arranged in the Neue Ausstellungshalle on the Kaiserdamm, will be an attraction for the general public also. Everybody will have an opportunity to take a glance into the laboratories and testing shops of modern industrial works.

Three groups of engineering materials will be dealt with—namely, iron and steel, non-ferrous metals, and electrical insulation materials. More than 200 testing machines, which will be shown in operation, will introduce the visitors to the latest methods of testing, which are not familiar even to many engineers. Inquiries on the part of foreign diplomats accredited in Berlin prove that the Continental and oversea engineering world is highly interested in this unique congress.

Detailed particulars are given by the "Geschäftsstelle der Werkstofftagung," Berlin NW7, Ingenieurhaus.

Will.—Mr. Joseph Lister Godlee, of Wakes Colne Place, Essex, Deputy Governor of the Gas Light and Coke Company, left £22,579, with net personalty £18,300.

ELECTRICITY SUPPLY MEMORANDA.

THE lighting season is approaching. There is ample demonstration of this in the tardier coming of natural light in the mornings, and its earlier resignation of duty in the evenings.

Lamp Price Reductions.

The Electricity Development Association are going to use the six months from Oct. 1 for making another national appeal for more business—this time, as already announced, through the local Circles, which are composed of electricity suppliers and contractors, and by advertising on (it is rumoured) the grand scale. The members of the Electric Lamp Manufacturers' Association have also announced that their contribution to the effort is to be the practical one of reducing the prices of gas-filled lamps—in fact, this event dates from the 1st inst. The reduction, the manufacturers say, "makes available the most modern illuminant at prices very little in advance of the vacuum type lamp, and should greatly stimulate the demand for gas-filled lamps for all lighting purposes." If it does so, we hope the new users of this type of lamp will do better than the majority of the old ones, and have them shielded so as to render them less noxious to their eyes. However, about the price reductions. They range from 2d. to 5d. per lamp, according to wattage and voltage. Clear glass lamps of 15 to 30 watts consumption, and between the voltage ranges of 25 to 30 and 100 to 130, are now priced at 2s. 3d., instead of 2s. 6d. Clear glass and inside frosted lamps, of 40 watts consumption and 100 to 130 volts, are also 2s. 3d., as against 2s. 6d.; while for 200 to 260 volt lamps, the charge is now 2s. 8d., instead of 3s. In the same group, 60-watt lamps, of the voltages mentioned, have been lowered from 3s. to 2s. 8d.; while 100-watt ones are now 4s. 9d., instead of 5s. In the opal glass type, 30 and 40 watt lamps (100 to 130 volts) have been reduced from 2s. 10d. to 2s. 7d.; 40-watt ones, for 200-260 volts, from 3s. 6d. to 3s. 1d.; and the same price obtains for the 60-watt ones. The 100-watt lamps (for the ranges of voltages stated) are down to 5s. 6d.—3d. less. Among the "daylight blue" lamps, there are now 40-watt ones (100 to 130 volts) for 2s. 10d., instead of 3s.; similar wattage lamps for 200 to 260 volts can now be purchased for 3s. 4d., as compared with 3s. 9d. The same price reigns for the 60-watt lamps, of both ranges of voltage; while 100-watt lamps are priced at 6s.—3d. lower. The new prices for the sprayed type of lamps are 1d., 2d., or 3d. less than the opal ones for the same wattages and voltages. The electrical contractors are not altogether pleased with the discount they receive in respect of business with trade users who are registered for special discounts. It is stated that many such users have a discount of 15 p.ct. or more, and the margin on the business with them is only 5 p.ct., which is considered quite inadequate, having regard to stocking risks and loss through breakages.

The Gas-Fire Season.

The makers of electric fires are also getting busy with their announcements for the coming season. There does not appear to be much in the way of novelty about which to talk. But the manufacturers profess the view that the coming fire season is going to see a big development in the general use of electric fires. One advertisement states that "everywhere electricity is becoming cheaper, and people all over the country more electrically minded." Then this urging: "Now is the time for an enthusiastic effort." Following is a little Americanism: "Start right now by asking for catalogues and folders, and ordering your stock." In view of the large demand that continues for gas fires, we are forced to the opinion that the demand for electric fires is of a relatively low order. When we consider the thermal value of the fuel that is used under steam-boilers, the proportion of that thermal value expended in raising steam, the expenditure of the thermal value of the steam in dynamo driving, and the remnant of the original thermal value of the coal that results as electrical energy, then it is a safe conclusion that, whatever the commercial price at which that energy can be supplied for heating purposes, it is dear compared with the labour-saving agent which the gas industry makes available direct from coal. Seeing that heat is heat whatever the agent, it will be difficult to make people "all over the country more electrically minded" so far as heating is concerned. In view of the conversions of heating arrangements that are made by the gas industry, it is clear that economy and utility are playing a more intensive part than the comparative novelty of heating by electricity.

The "Lyre" Fire.

We do not like the name for an electric heater; it is too suggestive, and a wrong interpretation might be applied when oral reference is made to it. The only thing about the heater that is notable is that it is in the form of a "lyre," and so is novel; but in producing novelty, it seems that utility has been sacrificed. In noticing the new design, "Hotspot" in the "Electrical Times" bemoans the regrettable fact that originality in designing is not a strong attribute of electric fire manufacturers. They do not seem capable of getting away entirely from traditional forms of earlier methods of heating, or from patterns—such as the picture frame class—that are commonplace. He also asserts that the incentive to strike out in new directions and to develop distinctive models is not encouraged by the existing conditions of keen competition; owing to the well-developed penchant of the makers of electric fires to copy each other's designs. However, in the new heater, the framework is in the form of a lyre, and in it Bastian "quartzalite" heating elements are fitted (seven or eight rods per fire), with control switches housed in the base. Any loading up to 3 KW. can be provided. Our friend points to one defect of the fire, which he describes as "serious." It has to do with fire risk. Special care has to be taken that the fire does not get knocked over when in use, and that ladies' dresses or children do not come in contact with the heated elements. Special removable safety guards are made for those who require them.

Death-Dealing Flex.

We are afraid it is too much to expect that those responsible for the conduct of electricity supply undertakings will pointedly inform electricity consumers of the danger there is in flex of which the insulation has become damaged. Not a few deaths at ordinary supply voltages have occurred through this. A short time ago a lady using a wireless set in bed, with a defective electric reading-lamp alongside, met with her death; and now (as briefly reported in the "Memoranda" last week) Donald Williams, who was only 14 years of age, has lost his life. He was found with the headphones of a crystal wireless set on his head. In his mouth was the end of the earthing wire from the set—presumably with the view of amplifying the sound. An electric reading lamp was beside the bed; and one of the wires was wound round the bedpost. The flex was frayed in several places. Evidence was given at the inquest that when the reading lamp or the bedpost was touched, shocks were felt. Medical evidence was given that the boy was in a perfectly healthy state. Mr. D. S. Richards, of the Newport Corporation Electricity Department, stated that the lead-covered system of wiring was used in the house; and the earthing connection of the lead sheathing had been disconnected from the water-pipe. The switches were on the neutral line; and there was a defect in the flex connected with the lamp. If this was connected with the bedstead, this would come within the circuit. Anyone who then came in contact with the bedstead would receive the full force of the current, which at the time was 230 volts. The death of the boy, in the opinion of Mr. Richards, was due to the leakage of the flex. The Coroner (Mr. W. Lyndon Moore) said there was no danger in a wireless set, provided electric wiring was not used as in this case. He suggested that the flex in electric installations should be periodically overhauled to guard against its becoming worn and the insulation defective. Inspection should also be made to see that leads were properly marked, and the switches safely connected.

The "Circle" Campaign.

The campaign by the Electrical Circles which the Electrical Development Association are organizing will include a large amount of advertising. A booklet containing a series of advertisements in the actual sizes in which they will be used has been prepared by the Association. It is stated that during the campaign, advertising will appear in London, national, provincial, and about 200 selected local papers, in addition to a number of magazines appealing to special classes of the public. For newspaper advertisements, a series of twenty-six have been designed. These deal with wiring and installation, lighting, domestic appliances, small heaters and cookers, large cookers, electric cleaners, &c. They incorporate the slogan for the campaign: "For Health's Sake—Use Electricity." The reply in all local gas advertisements should be: "For the Sake of Health, Economy, Good Service, and Reliability—Use Gas."

For Sale.

In our travels lately, we have met people who have been tempted to become the owners of modern "labour-saving" houses. These are not all bad habitations; but it is now frequently heard that, though for the size of the houses good prices are paid, there are many that are flimsy and damp. We have inspected some, and have seen the truth of this. The labour-saving equipment has been the bait, and not the structural qualities of the houses. These are usually built for sale outright; and, when once purchased, the owner has no means of escape, save by getting rid of his possession, at a sacrifice, to someone whom he, in turn, can persuade to become a purchaser. We know of certain of these houses which the tenants have been trying to sell for several months past; but they are finding that a bad reputation has an uncomfortable way of spreading. Cheap houses have also been put up by certain housing authorities; but, in these cases, it is found that cheap-

ness is usually realized by restricted accommodation. When equipped for electrical operation, the tenants find that the range of service is also restricted, while the cost, in comparison with other heating agents, is lengthened. A low house rent is in such cases inflated by the electrical costs; so that the poor tenant finds himself a victim, though he had been induced to believe he would be far better-off.

Water Power and State Aid.

"Electrical Industries" calls attention to two interesting reports on water-power developments in Italy and Norway. In considering the question of the prices charged for electrical energy in those countries, it is always well to remember that generating schemes are subsidized by the respective Governments, which generosity (so far as we know) is not extended to other industries. For example, in the report dealing with Italy, it is seen that, by a decree of July 9, 1926, the Ministry of National Economy were authorized to grant subsidies for the erection, re-organization, and working of thermo-electric stations, in which it is proposed to use national fuels. The subsidy is not to exceed lire 50 per annum per KW., and may not be paid for a longer period than ten years. In the case of Norway, the report, referring to State aid, says that on June 26, 1925, the Storthing passed a resolution to the following effect, with the view of aiding municipal electricity works labouring under financial difficulties, which was extremely kind of them: (1) The Crown was authorized to modify the terms of certain State loans granted to such works, provided other creditors agreed to similar modifications. (2) It was promised that a sum of Kr. 3 millions would be included in the Budget for 1925-26 to cover loss of interest, amortization, &c., in connection with loans granted or guaranteed by the State in the case of such works. (3) The Crown was authorized during 1925-26 to grant, or act as guarantor for, loans to such works up to a total of Kr. 5 millions on conditions to be laid down separately in each instance, and, if necessary, with entire or partial exemption from payment of interest and amortization in the case of loans advanced by the State. In the Budget for 1926-27, Kr. 1·2 million was voted to cover loss of interest, &c., in connection with State loans of the type referred to above. Thus subsidies, as well as water power, have a part in the price paid for electric current in Norway and Italy. The taxpayers contribute through the subsidies to the maintenance of the schemes.

Further Participation.

The foregoing does not exhaust the interest of the Government of Norway in electrical schemes. The report tells us that work on the Government scheme to harness the waterfalls at Nore has been considerably expedited; and it is hoped that two units of plant of 20,000 KW. will be finished by this autumn; and contracts have been accepted for the delivery of power from July 1 next. Long-distance transmission lines will also be completed this autumn and during next year. In aid of this scheme, the State granted Kr. 9·7 millions in 1925-26, and Kr. 15 millions in 1926-27. Up to June 30, 1926, the total expenditure of about Kr. 30 millions had been made; while it is computed that an additional outlay of Kr. 11·63 millions on the power works, and about Kr. 17·8 millions on the transmission lines will be necessary. Both reports give interesting details regarding various other schemes which are in hand, or have recently been completed. It is noticed that in Italy stand-by steam-driven plants are being constructed to assist in the work of generation during the dry seasons. The provision of these, as well as the construction of large reservoirs for the storage of water for electricity generation, together with the heavy subsidizing on the part of the Government, show that water power is not exactly all that it is represented to be financially, or from the point of view of constancy. The direct charge per unit of electricity does not constitute the whole of the cost to the people; part of it they have to pay whether or not they consume current—just as during the time we were subsidizing the coal industry in this country, the taxpayers were in effect indirectly paying something additional to the direct charge per ton of coal consumed.

THE "CALENDAR AND DIRECTORY" FREE TO "JOURNAL" SUBSCRIBERS.

Announcement by the Publishers.

Walter King, Ltd., the Proprietors and Publishers, have pleasure in announcing what is tantamount to a considerable concession in the annual subscription rates to the "GAS JOURNAL." A copy of each year's edition of "The 'Gas Journal' Calendar and Directory" will be supplied free to regular subscribers to the "JOURNAL"—an arrangement which has been rendered possible by an agreement entered into with Dr. W. B. Davidson, the author and compiler of the "Directory," who will continue to be responsible for the work.

"A POCKET ENCYCLOPÆDIA."

"The 'Gas Journal' Calendar and Directory," which is already familiar to a great many of our readers, was first published at the beginning of 1925; the price being 7s. 6d., post free. It was exceedingly well received; and the annual increase in the sales has proved that the little book found and filled a want. Though almost encyclopædic in scope, it is in truth a "pocket-book;" the cover measuring no more than 7 inches by 4½ inches, and the thickness being ⅝ inch. It is bound in limp red rexine, gold lettered, and with round corners.

The main divisions of the contents are as follows:

A Diary.—Ample space provided; one week to a page.

A "Calendar."—A compendium of highly useful information and tables. This was compiled, and is annually revised, so as to be of the maximum benefit to the Gas Engineer in his daily reference. Fifty-eight pages are devoted to this section; and the subjects are arranged in alphabetical order.

A Directory.—Forty-three pages are devoted to a list of the Gas Undertakings of the United Kingdom and Ireland; the particulars included being: C.V.; price; make in million c.ft.; make in thousands of therms; names of principal Officers.

An Advertisement Section.—This is printed on a heavy imitation-art paper, and provides much useful information attractively set out and profusely illustrated with half-tone blocks. This section is preceded by an alphabetical index.

ELIGIBILITY FOR THE "DIRECTORY."

The following are the current terms of subscription to the "JOURNAL:"

		One Year.	Half-Year.	Quarter.
United Kingdom & Ireland	Advance Rate:	35/-	18/-	10/-
	Credit Rate:	40/-	21/-	11/6
Dominions & Colonies & U.S.A. Payable in Advance		35/-	—	—
Other Countries in the Postal Union. Payable in Advance		40/-	22/6	12/6

It has been decided that the following classes of subscribers shall be eligible for the "Calendar and Directory:"

(*a*) Prepaid-rate subscribers for the year 1928.
(*b*) Continuous subscribers at the half-yearly prepaid rate.
(*c*) Regular credit-rate annual subscribers.*
(*d*) Regular credit-rate half-yearly subscribers.*
(*e*) Those who are supplied through a Newsagent or Bookseller, providing written application is made to the Agent.

The distribution of the "Calendar and Directory" will commence in December, as soon as subscriptions are received.

* Subject to the subscription having been on the Publishers' books since July, 1927, and being continued into 1928.

Swelling of Carborundum Refractory Material.

The "American Gas Journal" says that some gas engineers using carborundum refractory material have failed to take account of the fact that it grows in dimensions during ageing at high temperature. In a few cases, the effect of this permanent swelling under heat has gone so far as to split generator shells along rivet lines. This difficulty can be readily avoided by backing such refractory linings with a layer of clay run into place as a thick sludge between the refractory and the steel shell. This clay mass is plastic even after it has dried-out; and as the carborundum refractory expands, the clay is forced out over the top of the refractory layer, and thus affords space into which the expanding carborundum can grow. Engineers who have not previously laid carborundum brick in refractory installations are urged by those with experience to take careful account of the peculiar properties of this material.

"Health Week."—The Health Week Committee appointed by the Royal Sanitary Institute announce that this year "Health Week" will be held from Oct. 2 to 8. The object of the endeavour is to bring home to every man and woman in the country a sense of the importance of health and the responsibility for safeguarding it.

ENGINEERING EXHIBITS AT OLYMPIA.

With an influential list of patrons (including Sir J. Fortescue Flannery, Bart., Sir Robert Gardiner, Prof. H. S. Hele-Shaw, Mr. C. F. Botley, Mr. H. D. Madden, and Mr. John Wilkinson) and a businesslike Honorary Committee of Experts (among whom are Mr. Walter T. Dunn and Mr. Harald Nielsen), the ninth of the series of Shipping Engineering and Machinery Exhibitions was opened on Thursday last at Olympia. Visitors on that day found things in a state of preparedness which, it must be confessed, is the exception rather than the rule in connection with exhibitions; and this completion to time is a matter upon which both the exhibitors and the Organizers (Messrs. F. W. Bridges & Sons, Ltd.) are deserving of congratulation. It is an extensive display, the details of which are set out in an Official Catalogue weighing about a couple of pounds; and many of the exhibits are of a nature that renders them difficult to move into position. In fact, there is on the present occasion a much heavier weight of machinery than ever before. More exhibits than previously, too, are shown under power.

The exhibition is to remain open until the 24th inst.; and before that date arrives, a very large number of official visits will have been made to it. Monday of this week was the day fixed for the Institution of Gas Engineers, the London and Southern District Junior Gas Association, the Institute of Fuel, and the Institution of Chemical Engineers; and those members who were able to journey to Olympia saw—or if they go on a later date will see—much to interest them. Many things there are, of course, that appeal to all engineers; and many others that are of application to special branches. But few who start on a tour of inspection will feel inclined to turn away before having gone right through the exhibition.

WELDING AND CUTTING.

Among many features, perhaps one of the most noteworthy is the display of welding and cutting by all methods; no fewer than eighteen stands demonstrating this particular section of industry.

Demonstrations are made of oxy-coal gas machines cutting steel to required shapes and sizes, by Messrs. Hancock & Co. (Engineers), Ltd., and Messrs. R. Hancock & Sons, Ltd. The Quasi-Arc Company, Ltd., too, with whose system in connection with gasholder construction, &c., "JOURNAL" readers have already been made fully acquainted, show various types of electric welding plant, and all the varieties of "Quasi-Arc" electrodes. A self-contained plant capable of handling all gauges of electrodes, and therefore suitable for general welding work, is to be seen in operation. There are many examples of constructional work welded with these electrodes. Among other interesting things, Messrs. Siebe, Gorman, & Co., Ltd., show steel cutting under water with an oxy-acetylene flame.

MEASURING INSTRUMENTS.

Meters for all kinds of purposes are to be found on the stand of Messrs. George Kent, Ltd. Kent's shunt type gas meter provides an inexpensive and accurate means of measuring either clean or dirty gas, and is made suitable for sizes of pipe from 3 in. upwards. Various manometers for testing and record purposes are also displayed. Elsewhere are to be seen the coal meters of the Lea Recorder Company, Ltd., and other of their well-known specialities; and also "Electroflo" electrically operated steam, gas, water, air and oil flow meters, made by the Electroflo Meters Company, Ltd.

ENGINES, BOILERS, &C.

Details were given in last week's issue of the "JOURNAL" of one of the main attractions of the display made by Messrs. Babcock & Wilcox, Ltd.—the presentation, in a comfortably fitted-up room on the stand, of a four-reel film specially prepared to illustrate the manufacture of the Babcock boiler. A number of boiler models are also shown, together with special types of valves. Single-cylinder and three-cylinder Paxman vertical heavy-fuel oil engines are featured by Messrs. Davey, Paxman, & Co., Ltd. These engines are made in a range of sizes from 25 to 900 B.H.P., and embody complete accessibility to all wearing parts.

There are to be seen compressors of various sizes, and designed to meet differing requirements, made by Messrs. Reavell & Co., Ltd., including a new pattern high-speed quadruple air compressor; while Messrs. Stothert & Pitt, Ltd., exhibit examples of their positive displacement rotary pumps (Feuerheerd patent).

The Turbine Furnace Company, Ltd., exhibit a full-sized boiler front, complete with "Turbine" furnace, as applied to a Lancashire boiler; also a new extension grate and smoke-consuming baffle, designed to meet the new smoke regulations. The extension grate, it is stated, will be found very useful when cleaning-out fires, as any live fuel may be pushed back on to it and kept burning, thus minimizing the drop in pressure which is often associated with cleaning fires. The grate is then cleaned in the ordinary way, and fresh fuel thrown on to the bare bars. The live fuel on the extension is afterwards pulled forward on the top of the green fuel, and firing carried on in the usual manner.

COX'S IGNITE COMBUSTORS.

Flameless surface combustion on Cox's Ignite combustor system is shown by the Metropolitan Fuel Company, Ltd. The combustors are in various forms, and can be used vertically, horizontally, or inverted, thereby enabling heat to be applied exactly where required. In this system, the mixture of gas and air passes through the porous refractory medium, and is ignited on the actual surface of the opposite side, where it burns without flame—the surface only of the refractory medium becoming highly incandescent. From this it will be gathered that the system is available for use in atmospheres which normally would not support combustion. As an instance of this, the combustors can be used in a totally enclosed core oven, with no means of air admission, and with only a small orifice to permit of the escape of steam and other products which it is desired to drive-off. Complete apparatus or single combustors can be supplied for any purpose; or existing appliances in most cases can be converted to surface combustion by the insertion of combustors of suitable dimensions to provide the required heat. A glass tank is shown heated by a combustor immersion burner.

SCIENTIFIC INSTRUMENTS.

As would naturally be expected, scientific instruments bulk largely in an exhibition devoted to engineering interests; and in this connection particular mention may be made of the display of the Bowen Instrument Company, the Cambridge Instrument Company, Ltd., the Foster Instrument Company, and James Gordon & Co., Ltd. The last-named firm have, as already mentioned in the "JOURNAL," secured the patent rights for the British Empire and the Continent for the Hagan system of automatic boiler control. This system is controlling the boiler output of several million horse-power in various parts of the world. A working exhibit comprises a model installation, by which the application and operation of the system can be fully demonstrated.

FILTERS AND SEPARATORS.

Another stand containing much of interest is that of the Stream-Line Filter Company, Ltd., whose filters, based on the patented principle of edge filtration, have already been described in the pages of the "JOURNAL." The liquid to be filtered is forced, or drawn, between sheets of paper pressed together, more or less tightly according to circumstances. The solids present are wholly retained on the edges of the paper, while the filtrate passes on to the outlet through the extremely thin, flat passages between the separate sheets. Self-contained renovators for the recovery and purification of used lubricating oil are shown in three sizes, capable of handling lubricating oil at rates up to 72, 160, and 720 gallons per day, and arranged for gas, steam, and electric heating. One of these units is exhibited in continuous operation, delivering recovered oil in a condition equal to the original oil and ready for immediate re-use. A range of units for direct attachment to Diesel and gas engines is also shown. A cinematograph film of the continuous and automatic paddle type filter for dealing with liquids containing a high percentage of solids is displayed at intervals. These filters are made in two sizes of 100 sq. ft. and 500 sq. ft. filter area, and have automatic arrangements for cleaning the filter surface and recovering the separated solid.

On the stand of British Separators, Ltd., is a complete range of "Vickcen" separators and oil purifiers, applicable to the efficient purification of Diesel engine fuel and lubricating oil, turbine lubricating oil, &c.

CENTRIFUGAL CASTINGS.

Messrs. Newton, Chambers, & Co., Ltd., have acquired the rights of the Hurst-Ball centrifugal casting process, which has been operated hitherto by Centrifugal Castings, Ltd., Kilmarnock. The Thorncliffe Centrifugal Casting Department, established by Messrs. Newton, Chambers, & Co., to continue the operation of this process, exhibits typical examples of general centrifugal castings. The most important section is devoted to examples of the "Spun-Sorbitic" centrifugal castings recently introduced by this firm. These examples consist of piston valve liners and cylinder liners. They are the product of an entirely new modification of the centrifugal casting process. The outstanding advantages of "Spun-Sorbitic" castings are said to be their low silicon content (from 1 to 1·5 p.ct.), and the fact that they contain the maximum "Pearlite" requirements of combined carbon (from 0·80 to 0·90 p.ct.). By virtue of the special treatment, this combined carbon is obtained in the "Sorbitic-Pearlite" condition—a condition which is well known to be highly resistant to wear. "Spun-Sorbitic" cast iron has an advantage over ordinary "Pearlitic" cast iron in that it has an exceptionally fine grain size, due to the effect of the centrifugal casting process.

The Sheepbridge Stokes Centrifugal Castings Company, Ltd., are also makers by a patented process of centrifugal castings (in iron and non-ferrous metals) suitable for all parts where plain

cylindrical castings are required. The castings have high tensile strength, close grain, and small deformation under heat conditions, together with exceptionally high wearing qualities. The average tensile strength of the iron is stated to be 20 tons per sq. in.; and the castings are exceptionally free from blow-holes and other internal defects.

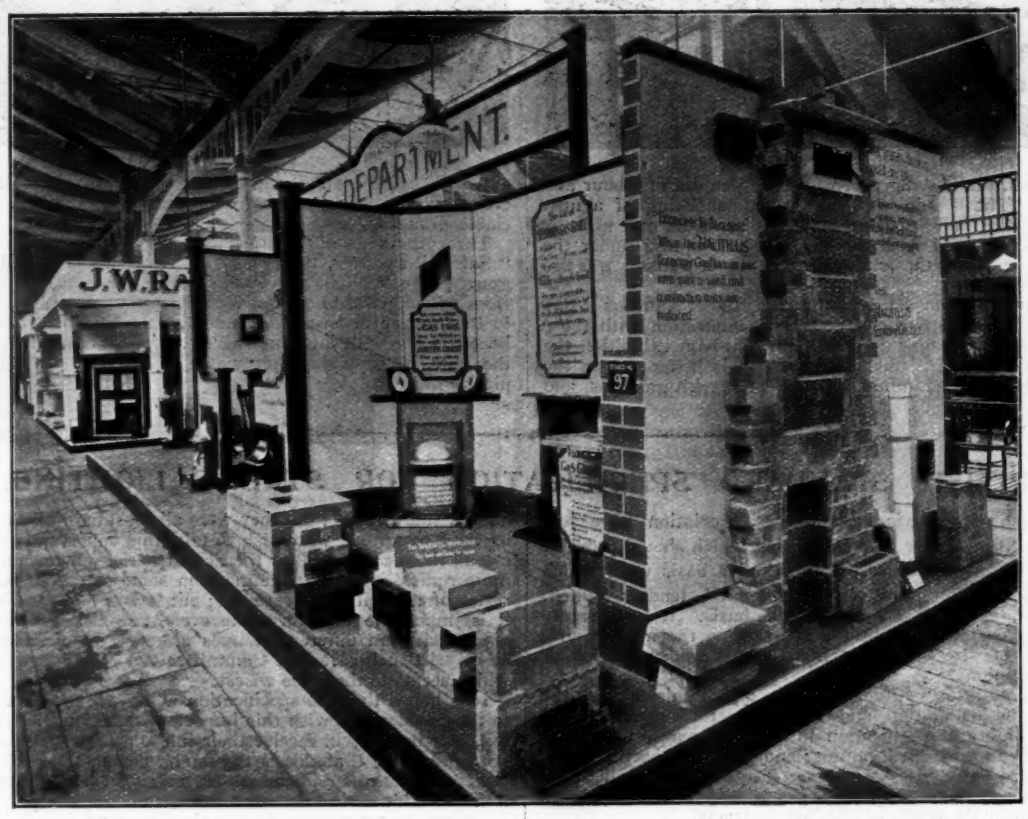
In another direction of usefulness, Electrolux, Ltd., present the "Electrolux" refrigerator, which is claimed to be the latest and most simple invention for really efficient cold storage. Without a single mechanical moving part to call for attention, and entirely without noise or vibration, it performs the full duty of the most elaborate mechanical ice plant for the preservation of foodstuffs and beverages, and for the making of ice. Once installed with an attachment to the gas or electric main and the water supply, it will continue to function indefinitely without adjustment, and at a trifling cost per day.

There are many other stands deserving of mention from a general engineering point of view; but these the visitor will find for himself. If he be a gas engineer, one stand in the gallery which he will not miss is that of Coin-Change Patents, Ltd., who show, and give demonstrations with, their change-giving slot meter attachment. This attachment is strongly made, and can be quickly and easily fitted to any existing type of meter. It is, the Company say, "to all purposes a shilling meter in collection, with the advantages of a penny slot meter in use."

"Clensol" is a liquid composition for clearing lime and scale deposit from all types of machinery and plant; and it is marketed by Messrs. Eeles & Moss (Clensol), Ltd. "Permac" jointing material and other specialities are shown by Messrs. Thomas & Bishop, Ltd. Working installations of "Permutit" and Lassen-Hjort processes are provided by United Water Softeners, Ltd. Both processes named are highly efficient and very popular.

BIRMINGHAM CORPORATION GAS DEPARTMENT DISPLAY

At the Midland Building and Allied Trades Exhibition.



Mention was made in last week's issue of the fact that, at the Midland Building and Allied Trades Exhibition now being held at Bingley Hall, Birmingham, a special display is made by the City of Birmingham Gas Department. From the views which we are now able to give of this exhibit, it will be seen that the display is a good example of how it is possible at small expense to get away from the "shop-window" style of stand, when one is dealing with an exhibition which has an appeal to a special class of the community rather than to the general public.

A real effort has been made to stage an exhibit which will interest architects, builders, and prospective house buyers in gas as a domestic fuel. It is only too well realized that the extent to which gas is employed in new property is very largely dependent on the initial equipment and piping of the houses. The cost of laying mains through new estates is a heavy one; and if the gas undertaking is to be reimbursed for this outlay, it is essential that the goodwill and interest of architects and builders should be aroused and retained. Money spent with this end in view is really a good investment; and the motto "Maximum Consumption per Service" was never of more importance than in new building estates.

At the Smoke Abatement Exhibition held in Birmingham in September, 1926, a slogan was adopted by the Birmingham Gas Department—"A Flue for Every Room." Nothing could be of greater assistance to gas salesmen than the universal realization by architects and builders of the importance of this slogan; and on the stand now under review it is again given prominence.

Failing the provision of this flue, several ways are demonstrated showing how efficient and permanent flues can be fitted to different types of gas appliances. The all-cast wash boiler in the kitchen is shaped so that it can be fitted in a corner; and from it an asbestos cement flue pipe is run-up inside the kitchen, turning-out and finishing with a suitable cowl. The circulator boiler is shown with a "Bentee" fitting fixed to the flue pipe inside the kitchen. This fitting, which is both neat and efficient, deserves to be more widely used, as it is simpler to fix than the separate bend and open-ended tee which it displaces, and its position in the flue can be regulated according to local conditions.

For the bedroom without a properly constructed flue, a method is shown of fixing a gas fire in the corner of the room with an asbestos cement flue pipe run-up in the angle and boarded out with asbestos sheeting. But builders and architects are always reminded that these are methods which are merely cures for an evil that should not exist—the evil of the improperly ventilated room.

DETAILS OF THE EXHIBIT.

A "Standard" one-level cooker, with oven and hotplate placed side by side and built-up as separate units, is shown fixed under a projecting hood, which is ventilated into an ordinary brick-built chimney. There is a "Corna" gas-heated wash boiler, built of cast iron, with rustless pan, and designed so that

the top will fit-up flush into the corner of the scullery; and also a "B.T.U." circulator boiler, controlled with a thermostat.

For the bathroom there is a Ewart's "Supreme" geyser. The water travelling through this geyser is at ordinary main's pressure, and can therefore be distributed to wash basin or sink, as well as to the bath. The geyser may be fixed in the kitchen or some room other than the actual bathroom.

The method is demonstrated by which 9 in. by 4½ in. gas fire flues may be incorporated in a 9-in. wall with only 4½ in. breasts

into the room, thus saving a considerable amount of labour and materials. The "built-in" gas grate, consisting of a neat mantel gas fire and raised hearth combined in one unit, is shown correctly fixed with the supply pipe running under the floorboards and hearth, and controlled by a sunken gas-fire cock with loose key.

As an alternative to a brick-built flue, the "Nautilus" gas flue cement blocks are shown; and in connection with these there is seen for the first time in a Birmingham exhibition the "Injector-Ventilating" flue block, which is being put on the market by Radiation Limited. It is for use with gas fires, and can be built into the chimney near the ceiling level of the room. It will act as an additional outlet from the room to the chimney, and will draw away the vitiated air which, being warmed, will naturally rise to ceiling level, and is best extracted at that point. Its insertion will also tend to standardize the pull on the gas fire for different heights of chimneys. This will be specially useful in cases where the gas fires are fixed in blocks of offices several storeys in height. The fireplaces on the lower floors of such buildings often suffer from excessive pull. The

extraction of the air at the ceiling level will enable one to increase the air change of the room without giving rise to appreciable draughts.

Three methods of heating for the garage are shown—the "Safety" radiator, the flames in which are protected by wire gauze; the "Balance" Radiator, air for which is drawn-in from and expelled to the outside air, so that there is no opening to the garage atmosphere round the flame; and a small gas-heated boiler built into the wall of the garage and lighted from the outside, supplying hot water to a system of circulating pipes.

BRITISH STANDARD SPECIFICATION FOR STREET LIGHTING.

The British Engineering Standards Association have just issued a Specification for Street Lighting which should prove of great value to all concerned. It provides a basis upon which street lighting installations can be compared, tenders invited, and installations tested, on an equitable basis. It furthermore specifies the technical conditions applying to the maintenance and testing of street lighting installations under service or working conditions.

The local statutory authority, the supply undertaking, the designer of the installation, and the manufacturer are interested in a street lighting specification in differing ways, which are liable to vary in different localities; and it has not been possible to sectionalize the clauses of the specification to suit all conditions. It has been left to the parties concerned to adopt such clauses as meet the needs of possible contracts.

The importance to the public of well-lighted streets cannot be over-estimated; and it is the opinion of some competent observers that the present standard and quality of illumination in many artificially-lighted streets should not be accepted as good British standard practice. It has therefore been felt that a British standard specification must deliberately set a standard of street lighting which is higher than that commonly existing at the present time. For this reason, it has been decided to omit altogether from the categories of the specification a type of lighting—sometimes spoken of as "beacon" lighting—in which lamps are placed at such wide intervals that they indicate the edge of the road rather than illuminate the highway or the vehicles and pedestrians using it. There is no doubt in the minds of those responsible for this specification that during the next few years the trend will, and should, be towards higher and better distributed street illumination; and the standards have been set to anticipate the immediate future rather than to stereotype the past.

Prior to its issue, the specification was given a very wide circulation; over 1000 copies having been distributed to the various Institutions and Associations interested, and their comments invited. It was also discussed before the Institution of Electrical Engineers, the Council of the Institution of Gas Engineers, and the Illuminating Engineering Society, while a paper on it is to be presented at the forthcoming meeting of the Institution of Public Lighting Engineers. In principle, the specification was most favourably received, and has awakened a wide interest. The comments received were too numerous to answer individually; but they were all most carefully considered by the Committee, who wish to take this opportunity of thanking all those concerned for their constructive suggestions. Some quite radical changes were made in some of the clauses as the result of the criticisms received; but it will be appreciated that it is impossible to incorporate everyone's desires when views expressed from different sources are directly opposed to each other. In such cases the Committee can only adopt the course which seems to them the wisest.

It is hoped that the specification will prove of practical value to those concerned with this important question of street lighting, and that it will receive their full and active support. It is not anticipated that this is the final word on the subject. The British standard specifications are reviewed periodically; and it is hoped that as this specification is put into use proposals for its improvement may be sent to the Secretary.

The attention of those who received copies of the first printed proof of the specification for comment is called to the fact that the published specification contains many quite important changes; and they should therefore procure a copy of the published edition, which can be obtained from the "B.E.S.A." Publications Department, 28, Victoria Street, London, S.W. 1, price 2s. 2d., post free.

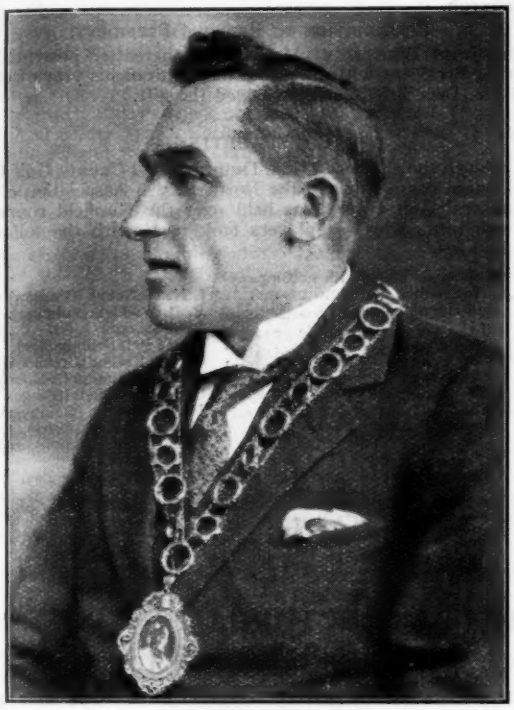
Gas in Concrete Houses.

The "Sunday Chronicle" has just issued a booklet (price 1s.), which we understand is going out in large numbers. It describes the "Sunday Chronicle" concrete house built at Kingsbury, which constitutes the prize in a novel competition of skill in home planning. The book mentions among other things that Nautilus "Economy" flues are fitted to take the place of the orthodox brick chimney, thereby saving large sums in building construction; and, as an example, it is stated that over £62 was saved in the construction of two small houses. Also pointed out is the further advantage of the Nautilus system of gas-flues—that the fireplace can be erected in any position in the room, irrespective of those in the rooms above and below; and that the flues ably withstand the effects of great heat, condensation, and weather conditions. References are also made to the fixing of the Richmond "Bungalow Junior" gas cooker in the scullery, and to the installation of Wright's "Viking" gas-wash boiler.

NORTH BRITISH ASSOCIATION OF GAS MANAGERS.

REPORT OF THE PROCEEDINGS AT THE ANNUAL MEETING IN DUMFRIES.

The Sixty-Sixth Annual General Meeting of the North British Association of Gas Managers was held in the Town Hall, Dumfries, on Thursday, Sept. 8. Mr. JAMES BELL, of Dumbarton, the President, was in the chair. The following is a report of the proceedings; and the William Young Memorial Lecture, which was delivered by Dr E W. Smith, and the papers by Mr. R. S Sturrock, of Ardrossan, and Mr. James Campbell, of Dunfermline, are published on later pages of this issue of the "JOURNAL."



THE PRESIDENT,
Mr. James Bell, of Dumbarton.

A CIVIC WELCOME.

The PRESIDENT said they were honoured that morning in having with them Provost O'Brien, the esteemed Civic Chief of Dumfries. Police Judge Hastie, the Convener of the local Gas Committee, was unable to be with them, but his Department was represented by Police Judge Cockerbie, the Vice-Convener.

Provost O'BRIEN welcomed the members of the Association. He explained that the Town Hall buildings would be fully placed at their disposal.

The PRESIDENT, in acknowledging the civic welcome, said the Association made no apology for selecting Dumfries as the venue of their sixty-sixth annual meeting. This was the first conference of the Association in Dumfries, though in 1874 the old West of Scotland Association of Gas Managers held a meeting in the town. He had been informed that the meeting in 1874 took place in the very building in which they were assembled that day. The transactions of that meeting had a special interest on the present occasion, because of the prominent part taken in the discussion by the late William Young, whose memory they were perpetuating at the present meeting in a special lecture which would be delivered by Dr. E. W. Smith. At the meeting in 1874, Abraham Malam, then Gas Manager at Dumfries, read a paper on "Improved Modes of Carbonizing Coal in the Production of Illuminating Gas." The paper described a process patented by Mr. Malam, by which he claimed to improve the yield of gas per ton without impairing in any way the illuminating power. This claim was hotly contested by William Young, with the result that the discussion on the paper became largely an argumentative debate between these two stalwarts.

COUNCIL'S ANNUAL REPORT.

The PRESIDENT formally moved the adoption of the Council's annual report.

Mr. JAMES CAMPBELL, of Dunfermline, seconded the motion, which was agreed to unanimously.

NEW MEMBERS.

The SECRETARY (Mr. D. Fulton, of Helensburgh) reminded the members that the annual report of the Council contained a list of names of gentlemen whom the Council recommended for admission to membership of the Association. Since the report was printed, however, further applications had been received from the following: Ordinary—Messrs. James Blair, Gas Manager, Dingwall; Archibald McAlpine, Gas Manager, Pitlochry; Wm. Phairn, Gas Manager, Newmilns; and James Wilson, Gas Manager, Dalry. Extraordinary—Messrs. James Reid, partner with Mr. J. B. Macdermott, of Glasgow; and Charles Pawson, Sales Manager to Messrs. George Bray & Co., Ltd. Associates—John C. Carmichael, Assistant Manager at Hawick; and John B. Ferns, Assistant Manager at Hamilton. The additional list of names had been submitted to the Council, and had been approved by them.

The meeting concurred in the admission to membership of the gentlemen mentioned.

THE SECRETARYSHIP.

Mr. WILLIAMSON, of Forres, asked what the Association proposed to do in connection with the secretaryship, seeing that there was every likelihood Mr. David Fulton would be elected Junior Vice-President.

The PRESIDENT explained that the point had been discussed in the Council. Mr. Fulton was willing to retain the secretaryship until the end of the current financial year.

Mr. WILLIAMSON observed that in past years the Council had appointed secretaries without consulting the rank and file of the members. His own view was that this was an appointment which should be made by the members of the Association at a general meeting.

The PRESIDENT replied that the Association gave the Council power to appoint a secretary.

THE ANNUAL SUBSCRIPTION.

Mr. R. W. COWIE, of Hawick, asked if the Council had recently given any consideration to the question of the annual subscription. Some years had intervened since the subscription was raised; and he wondered if there could not now be a re-adjustment to the old rate.

Mr. DAVID FULTON replied that every year the Council gave attention to the matter. At present it was impossible to revert to the old rate.

WILLIAM YOUNG MEMORIAL LECTURE.

[Reproduced on succeeding pages.]

The PRESIDENT said they had now reached what he considered was the most important point of the programme—namely, the William Young Memorial Lecture. The lecturer was Dr. E. W. Smith, of London, who had chosen for his subject "The Economics of Scientific Control in the Production of Town Gas." Dr. Smith required no introduction to the members of the North British Association of Gas Managers. He had been with them on several occasions, and he was an authority on subjects pertaining to scientific work in gas-works, particularly on the carbonizing side. They were gratified to have Dr. Smith with them, especially as he had put himself to considerable inconvenience to fulfil the engagement.

VOTE OF THANKS.

Mr. H. H. GRACIE, of Edinburgh, in moving a vote of thanks to the lecturer, remarked that recently he had the pleasure of being associated with Dr. Smith in some technical work in Edinburgh.

Mr. J. W. NAPIER, of Alloa, in seconding the vote, said he desired to associate himself with the enthusiasm displayed by Dr. Smith in his admiration for scientific control. He was not aware of any greater influence that had been brought into play in the forces of the gas industry than the scientific education of young men. The evidence of this was to be found in the fact that Leeds University was directing studies on the science of gas production and utilization. Then they had the Institution of Gas Engineers' own Education Scheme, which he trusted would in the future provide scientific men for the industry. Dr. Smith was strongly of the view that in the forces of industry there should be association of minds. It was, however, his (Mr. Napier's) belief that this, if carried too far, was dangerous to individual development. Of course, more than mere industrial knowledge was necessary. A broad knowledge of life was essential. Undoubtedly the university-trained man would be the man of the future. In this connection he suggested that the Association, by way of encouraging young scientists in Scotland, ought to award a prize to the best student of the year, or for original work in particular studies. The William Young Memorial Fund was in a good position. Could not some of the money be utilized? He congratulated Dr. Smith on the inspiration he had given to them all by his lecture.

Dr. SMITH, in replying, remarked that the time he had spent

at Granton, while being associated with Mr. Gracie in certain technical work, had proved most enjoyable.

Mr. L. HISLOP asked if anything could be done in regard to the suggestion put forward by Mr. Napier. He (the speaker) was not sure that the William Young Memorial Fund would be available for this purpose. If a prize scheme could be inaugurated, it would interest and encourage the students. He believed that a capital sum for such prizes could be found.

Mr. J. W. NAPIER suggested that the prize ought to have a substantial monetary value.

The PRESIDENT gave an undertaking that the point raised by Messrs. Napier and Hislop would be referred to the Council in due course.

PRESENTATION OF CERTIFICATES.

The PRESIDENT thereafter presented Institution certificates to the following: Messrs. Alfred Anderson Macfarlane (First Class in Gas Engineering and Gas Supply); John Boyd (Second Class in Gas Engineering); Alexander Macdonald (First Class in Gas Engineering); Thomas Moncur Duncan (Second Class in Gas Engineering); and Henry Lorimer (Gas Supply and Gas Engineering).

DIFFERENTIAL CHARGES FOR GAS.

Before the adjournment for luncheon, Mr. JAMES CAMPBELL, of Dunfermline, read a paper on "Differential Charges for Gas." This will be found on later pages.

GAS BLENDING.

Following the luncheon, Mr. Campbell's paper was discussed, and a paper by Mr. R. S. STURROCK, of Ardrossan, on "Gas Blending" was also read and discussed. This paper is also published on succeeding pages.

NEW OFFICE-BEARERS.

The PRESIDENT announced that the new President was Mr. H. H. Gracie, of Edinburgh. Mr. J. W. Napier, of Alloa, automatically became the Senior Vice-President, while Mr. David Fulton had been elected Junior Vice-President. Messrs. James Jamieson (Edinburgh) and Antony Nisbet (Paisley) were the two new members of Council.

Mr. H. H. GRACIE, in accepting the Presidency, said he would do his best to maintain the great traditions of the Association. His Convener, Councillor Harvie, would have liked to be with them that day, but the Gas Committee of Edinburgh were meeting then. He had, however, been good enough to send the following telegram: "Committee congratulate you on your appointment as President of the North British Association. Lord Provost's Committee are extending an invitation to the Association to meet in Edinburgh next year." On behalf of the Corporation, Mr. Gracie formally invited the Association to Edinburgh.

PRESENTATION TO RETIRING PRESIDENT.

Mr. JOHN WILSON, of Motherwell, thereafter presented the retiring President with the usual memento of his year of office; and Mr. BELL briefly acknowledged the gift.

GOLF MEETING.

Through the courtesy of the Dumfries and County Golf Club, the annual competition of the North British Association of Gas Managers' Golf Circle was held over the Nunfield course on the 7th inst., when 42 players took part, with the following results:

Challenge Bowl, with accompanying replica	J. H. McKellar (Glasgow).
2nd Handicap	R. B. Waddell (Polmont).
3rd "	J. R. Stevens (Elie).
4th "	James Bell (Dumbarton).
5th "	George Keillor (Greenock).
6th "	F. W. Richmond (London).
7th "	Geo. A. Mitchell (Glasgow).
8th "	John Anderson (Edinburgh).
Scratch Prize, a tie between	Henry Rule (Kelty), J. H. McKellar (Glasgow), and J. R. Stevens (Elie).
Special Prize	R. L. White (Glasgow).

The President of the Association, Mr. James Bell, of Dumbarton, did the sixth hole (166 yards) in one.

WILLIAM YOUNG MEMORIAL LECTURE.

THE ECONOMICS OF SCIENTIFIC CONTROL IN THE PRODUCTION OF TOWN GAS.

[Delivered by E. W. Smith, D.Sc., F.I.C., at the Annual Meeting of the North British Association of Gas Managers, Sept. 8.]

The title of my lecture is an unfortunate one, because it is not clear in its significance; and even if it were, it would not correctly express what I desire to talk to you about this morning.

William Young, as one of the early pioneers, carried the flag of progress and development in the gas industry in his day a great deal further, and much more prominently than many of his contemporaries. The term "thorough" within the limits of his knowledge, experience, and capacity could be applied to him and his work in very truth. He was painstaking, logical, hardworking, thoughtful, and scientific in his attitude towards all problems that were presented to him. It is an honour to be allowed to present the William Young Memorial Lecture during this year of 1927.

William Young's work is too well known to you for it to be worth while my recapitulating its leading features. Much of what he did is useful even to the present day, and the ideals and methods which characterised him may, with great advantage, be copied by all who desire to see the gas industry prosper.

The subject of my talk to-day may be open to much misunderstanding. It is given at the specific request of a number of personal friends; it is given with great humility, and a feeling that my own limitations in discussing the subject are very great. It is, however, given because I feel that only by the reiteration of ideas, which should almost be designated platitudes, can any real conviction be brought home to those who can have influence in the direction of affairs, both big and small, and any really rapid progress be made in the direction I propose to indicate.

In the title of this paper I have used the word "Economics." It may be literally out of place, and the word "value" might more correctly be substituted. The subject would then read "The Value of Scientific Control in the Production of Town's Gas."

THE MEANING OF SCIENTIFIC CONTROL.

Now, what do we mean by Scientific Control? I mean that type of control which is based on exact knowledge and a proper co-ordination of past experience, accumulated data, and fundamental facts, in contradistinction to reliance solely on rule-of-thumb methods, conventional adjustments, and "cookery book" means, which accept the experience of the past as being final arbiter of the procedure of the future, and have for their objective tranquillity, peace, and an assured dividend, without any reference to the obligations of the industry to provide the best possible public service at the lowest possible cost.

It will be noted from the above that I am not proposing to concentrate to-day solely on the question of the value of the chemist on the gas-works. In the first place, the mere employment of a chemist does not ensure scientific control. The chemist may not be properly trained, and may be nothing more than an efficient tester. Scientifically trained chemists cannot be expected to be of much use to the gas industry unless the inducements offered to them, financially and otherwise, are greater than is the case in the major part of the industry. A good technician is of no more use in the employ of someone who does not know how to use him than an aeroplane in the hands of a tyro, however good the tyro may be in other directions.

The gas industry is not peculiar in any way in its attitude towards the greater application of scientific methods from the attitude found in many other important industries. It has, nevertheless, certain definite peculiarities. It is one of the largest industries in the country. It is one of the few industries which can be termed a key industry, and essential to the wellbeing of the community. It is a public service of a high order, and it is one of the oldest of present-day industries, as we know industry to-day. It is largely restricted in its activities by Government control. It has the monopoly for its main product in its district of supply. It is the most chemical of all our industries, and the most amenable to scientific control. Many of the difficulties which would arise if suggestions were made for a greater co-ordination in other industries do not arise in the gas industry. Co-ordination is comparatively easy, as has been frequently demonstrated; but in spite of that the co-ordination, co-operation, and scientific development of the industry, great as it has been, are negligible compared with what might be. There need be no competition or diversity of interests between undertakings. There is one industry working for the national good, and the interest of one undertaking need not conflict with the interests of another.

It is well known that the defects of individual undertakings do seriously react on the working of other undertakings; and in my humble opinion the gas industry could be made in effect into one big trust with great advantage to it and to the community as a whole. Such a trust would eliminate a great deal of waste and redundancies, and would automatically bring about co-operation, central selling organizations, centralized bye-product manufacturers, &c.

But I am getting along a little too quickly with my subject. A great deal too quickly, I have no doubt, for my hearers.

THE SCIENTIFIC ATTITUDE OF MIND.

The scientific attitude of mind is being applied in many directions throughout the ramifications of the gas industry. Salesmanship is now a science, although, owing to the lack of thorough grounding in the subject, much of the effect of scientific coaching in salesmanship amounts to a series of stunts and methods of obtaining orders, rather than a real development of the understanding of the buyer and the study of his requirements. This is unfortunately the case in the beginnings of such things.

The application of scientific principles needs to be made from the top to the bottom of all industrial concerns, including gas undertakings, to the limit of what is practicable under existing conditions. If that were done, it would not take long before much improvement were brought about. There is as much necessity for scientific methods to be applied to the organization of the undertaking as a whole as there is to the organization of chemical tests, or the running of a recognized chemical process. A scientific attitude of mind is necessary in the manager in making decisions of all kinds, whether in the apointment of staff, the correction of difficulties, the purchase of coals, or anything else. The accountant and the cost clerks should be more than numerical manipulators. How often it has been found that dissections and costs which have been got out are useless until there has been a number of meetings between the accountants and those who are running the processes. How often in some of the larger undertakings the bogey of the operator is the accountant, whose six monthly, or twelve monthly, figures cannot be scientifically rebutted, although the operator may be able to bring evidence of a conclusive nature that the figures cannot be right. This is not only the fault of the accountant, but also the fault of the management in not creating a more hole-proof organization.

Another direction in which criticism may be made of lack of scientific method in our industry is in the means adopted for charging for gas. It is only latterly that there has been any move to alter this, and I believe it is proposed that greater freedom shall be given to gas undertakings as regards differential rates. A scientifically trained accountant, possessing courage, imagination, a knowledge of the industry, and insight can be of enormous value to an undertaking possessing him, as compared with that undertaking possessing an accountant having only the tools of a conventional training.

INDUSTRIAL GAS SALES.

Then I want to touch on the subject of the advantage of the scientific attitude of mind as regards the development of industrial gas sales. Industrial gas sales depend on—

1. Cost of gas.
2. Development of scientific methods in the utilization of gas.
3. Scientific methods in the development of the sales of industrial gas.

The objective in the desire which is general to encourage the sale of industrial gas is that it is an excellent type of load, and one which, in the ultimate, should have the effect of reducing the cost of production of gas. There are undertakings which develop extensive, but essential, furnace demonstration rooms, and employ the necessary staff of a specialized kind for the purpose of increasing sales of industrial gas, and yet in some cases such organizations are run with the objective of directly paying their way out of the profits made by the sale of furnaces. It is well recognized that one of the main difficulties in the sale of industrial gas is in the first cost of efficient equipment; and when gas undertakings, in their desire to make individual sections pay directly for themselves, increase the cost of such equipment by anything from 10 to 20 p.ct., they would appear, in my judgment, to be neutralizing, or even nullifying, most of the advantage that should accrue from the expense entailed in the organization of an industrial sales department. The consumer is hit at his most vulnerable point. However he may have been convinced of the advantages of gas in other directions, that material increase in capital cost kills the business in many cases. I have met many showroom superintendents, and industrial gas salesmen, whose main objective has been to make a profit on the sale of furnaces. They have agreed that the primary objective of the undertaking is to sell gas; but as they have to stand or fall by the profits made in their own department, rather than in the increased output of gas for industrial purposes, they have no direct immediate interest in simply confining themselves to the main objective. The consumer always pays, and the furnace maker, in allowing a gas undertaking 10 to 20 p.ct. on the price of a furnace, has to put that 10 to 20 p.ct. on to the price for the consumer before he can pay it to the gas undertaking.

This cannot be the policy of anyone who has a scientific attitude of mind. It is not a matter of opinion, nor one of convenience. It definitely kills business, as can be proved from countless instances; and those undertakings who are capable of developing their industrial sales under such a system would pay much better still if they modified the system.

The question of scientific development of furnaces has been fully recognized as being of supreme importance in America, where the gas industry is subsidizing research in a very big way in connection with the utilization of gas for industrial purposes, with enormous advantage to all concerned. The value of such development is little recognized in this country, and the possibilities are enormous.

It would pay headquarters to appoint a small commission to make a study of the whole subject both here and in America with a view to taking full advantage of such possibilities.

The value of scientific control can be demonstrated very well by a study of the development of the gas fire during the last twenty years. The modern gas fire of the better type has as much scientific precision as the modern electric motor. There is a justification and a reason based on fundamental evidence, and evidence gleaned from deduction and experience for practically every detail which goes to make up the modern gas fire. Practically the same can be said for the modern carbonizing plant; and both developments are due to the close application of the scientific attitude of mind and fundamental considerations to the problem of attaining a greater approximation to perfection.

Many gas undertakings have every desire to take advantage of possibilities of the application of science to their undertakings; many are very successful in most directions in their efforts. In some the extra advantages which might accrue are lost largely through a lack of imagination in the adoption of the large view. Old methods are often worked so scientifically well that it would be impossible to get better results with these plants; but it can be safely said that if the same care in the application of scientific methods were to be given to more modern developments, of which there are many available, still greater advances would be made.

In this talk I do not want to neglect altogether the subject of the importance of chemical and physical research in connection with scientific control of the gas industry.

THE USE OF RECORDING INSTRUMENTS.

One of the main points I wish to bring out is that chemical and physical research, and chemical and physical data and statistics, obtained in connection with both production and distribution are wasted unless those whose business it is to make use of such research data and statistics have a scientific attitude of mind, and are capable of using such information correctly. I am one of those who believe in the much extended use of recording instruments, such as CO_2 recorders, specific gravity recorders, and pressure recorders, among many others, but the mere installation of such apparatus is relatively valueless unless—

1. They are installed in the most suitable positions.
2. They are capable of working consistently and reliably.
3. They are supervised and kept in order, so as to give the results they are capable of giving.
4. The most important of all—the information obtained is assembled and co-ordinated, and used with the discrimination which will ensure the evaluation of accurate deductions from the data obtained.

My experience of the use of such instruments, including especially gas analysis apparatus, is that in too many cases the instruments are looked upon as being infallible, and that data and statistics are assembled over periods of years which, when examined by anyone with a scientific attitude of mind, can be judged, in many cases, as grossly inaccurate and more misleading than if the data had not been obtained. I have seen columns of gas analyses of waste gases which, over long periods, have been inaccurately taken, and anyone with any knowledge whatever of the subject would have spotted that to be the case. The fault is nearly always to be traced to the employment of juniors with insufficient training to do such work, and supervision by seniors who rarely analyze the results, and whose training has not equipped them as competent supervisors.

The engineer must feel that he can rely on the chemical tests that are carried out, and this can be assured by the employment of competent analysts. Greater precision means saving money. Approximation in connection with the sales side of undertakings means loss of money, because the buyer does not depend on approximation. Greater accuracy in the control of production of gas of a given calorific value under the new method of selling gas means a closer working with safety to declared calorific values. The closer the working, the less excess calorific value will be given to the consumer, and the more gas will be available for sale.

There are still many works which do not employ a chemist; there are still more that employ him inadequately. It is only the very small works that cannot afford to employ a chemist. Under the proper conditions a fully qualified competent chemist can justify his employment very readily if he is used in the right way; but he must be given more responsibility in his own work, be made to stand or fall by his results, and brought into intelligent consultation on all matters relating to production.

COST OF CHEMICAL TESTING.

I have made it my business in recent years to keep in touch with the costs of technical work in progressive gas undertakings. Among the larger undertakings it may be taken that

the average cost of chemical testing, including everything, amounts approximately to one-thirtieth of a penny per therm, while the cost of special chemical research does not amount to more than one hundredth of a penny per therm. As the larger undertakings are the ones that feel they can afford chemical testing and chemical research, and the medium-sized and smaller undertakings can afford less, it can be taken that chemical testing will cost a little more than this in the medium sized undertakings, and chemical research less. There are one or two exceptions to this generalization. There are a few undertakings that are carrying out valuable research work, much of which is made available to the gas industry.

I regret to say that, owing to lack of proper control, a small proportion of the technical papers that are published in connection with our industry, while interesting, are of little technical value. This is due to the fact that the data are incomplete, much being unco-ordinated, and the paper of necessity based on technical information data and statistics, which are not always relevant, or even accurately determined. If this be the case, it is very difficult for the ordinary man on the works to evaluate one paper with another. The value of any technical paper should be in its analysis and dissection rather than in the assertions made and the conclusions drawn by the author, and there should always be sufficient reliable information and statistics to enable the reader to make his own assertions and draw his own conclusions.

The ideal state of things would be for all papers presented to the Technical Institutions to pass through the hands of a body of independent competent censors, who would satisfy themselves as to the form of the paper, its completeness, and its reliability. This applies, of course, only to purely technical papers, and not to papers which are primarily descriptions of processes and plants.

The most valuable section, however, of the research work done for the gas industry is carried out under the auspices of the Institution of Gas Engineers and the National Gas Council. Great advances have been made in the amount and quality of such work, especially in its immediate applicability to the requirements of the industry. Now, I cannot help but feel that the work requires to be done in a much more comprehensive way, and on a much larger scale. From published information it would appear that the total amount of money spent by the gas industry, directly and indirectly, in connection with research is less than £6000 per annum, or about 5d. per million cubic feet of gas made, or one-two-hundredth per thousand cubic feet made. This is by no means the maximum amount that could be afforded by the gas industry for this purpose. It should be possible in the immediate future to allocate £20,000 per annum for systematized research, or 0·015d. per thousand.

I am a great believer in the work of the British Commercial Gas Association; but I do not feel that there should be any further increase in the amounts expended on publicity and advertising if such increase is only possible at the expense of what should be done in connection with the development of research. The whole subject is worthy of the fullest inquiry. Research can be made popular, because it can be shown to be useful and to pay; and if defects in the organization of research do creep in, it is always possible to remedy quickly such defects without cramping research and restricting it.

Committee Meetings.

One of the important expenses in connection with research is in the calling of meetings; and when such meetings are frequently joint committee meetings, the number attending may be large. My experience in other directions is that large research committees are a waste of money, only a very small proportion of those attending being in a position to contribute anything to the prosecution of the research. Out of the nature of things this must be so. One would like to see committees appointed, and occasionally changed in their personnel, consisting of people who are prepared and willing to specialize in the work of the particular committee, and let the General Council of the Institution be the body that decides on general policy. It would then make it possible for committee meetings to be called a little more frequently; a procedure which would inevitably give satisfaction to the research workers, and could not help but be salutary.

I am certain that the industry could afford to pay more for research. I am equally certain that more research, if properly organized, would pay the industry. That much has already been done in a comparatively small way has, I understand, more than justified itself in the view of those who are competent to judge. If anything that I say to-day will encourage an extension of such research, then this lecture will have been worth while.

Contractors and the Gas Industry.

I shall probably be criticized for not being more constructive in what I have had to say. I would like to see the industry better organized technically and scientifically. Such organization is not confined to chemical research. I would like to see standing committees of real specialists dealing with matters such as purification, industrial gas, distribution, carbonization, refractory materials, and gas registration. These committees would have their own chairmen and secretaries, and enthusiastic specialists would collaborate and assemble, dissect, and evaluate all the known information and current experience available in their own subjects, and who could act, in case of need, in an advisory capacity to gas engineers in difficulties, when consulting engineers are not in a position to give the broad advice that would be required. I should like to see a closer systematic official collaboration between the contracting side of the industry and the producing side. Very little inquiry will convince any open-minded person that the contribution of the contracting side to the progress, advancement, and development of the industry has been a substantial one, and one which more than justifies my claim that it should be associated with the producing side officially and formally in most of the technical work of the industry. It may be said that individuals are so closely associated, and that there are dangers in a closer connection. Such dangers, to my mind, need never be experienced. There is no difficulty of this kind in the American Gas Association; and when there is a likelihood of danger arising, it lies in the hands of the gas engineer to promptly nip such dangers in the bud—a task which is rendered all the more easy because the good sense of the large majority on both sides will always ensure the common good.

I do not think I can do better than wind up this rambling dissertation by quoting some paragraphs from a statement by William Young in 1875 before your Association. He said:

"Since joining this Association and coming into intimate contact with its members, I have been quite surprised, and at the same time much gratified, to observe the anxiety displayed by its members to become better acquainted not only with the merely mechanical details of their profession, but also to acquire a knowledge of the physical and chemical laws upon which their manufacturing process is based, and I am the more especially pleased to see this trait in the character of the members, as I am sure that it is only by the acquirement of such knowledge that the manufacture of gas can be brought to its utmost state of perfection, and able to compete with other modes of illumination. The old 'rule of thumb' mode of manufacture will no longer be tolerated, and it will be those among us who have made the profession a science who will succeed in the battle of life.

"During the past twelve months, partly on account of ill-health, and partly from having extra duties to perform, I have not been able to do much practical experimenting on the manufacture of gas, and consequently have nothing of a very practical turn to bring before you to-day, but although the hands have not been able to work, the mind somehow or other has had time to think.

[Here follows experimental lecture on diffusion, &c.]

"My principal object in bringing them before you to-day was to foster among our members the taste for a higher technical education, and with the hope that this might induce some of the members, more particularly the younger and more energetic, to take up the subject and experiment for themselves.

"I have not the least doubt that there is a great future for electric lighting. The more quickly therefore that we put ourselves in fighting position the better; and this, in my opinion, can be done only by bringing to bear upon the subject more energy and a higher scientific training."

Daniels comments that "The natural tendency of William Young's mind was, what Buckle says in his 'History of Civilization,' the distinctive tendency of the typical Scottish investigator to use the deductive as against the inductive method—that is, not to try out a lot of things and see what happens, but to marshal the existing knowledge to think it out well, to conclude that probably the best method would be so and so, and then to see how it works."

"Intensely practical man with an intensely scientific mind." (Lord Beaconsfield described the practical man as the man who practises the errors of his forefathers.)

William Young himself, in urging the necessity of technical instruction, dismissed the merely practical man, not without a touch of kindly pity, as an imitative animal helpless in the face of new conditions.

We cannot, therefore, do better than follow in the footsteps of William Young. He had the scientific attitude of mind, believed in technical training and research, and would no doubt, if living-to-day, desire to see the application of scientific methods to every branch of the carbonizing industry.

Setting Bolts in Concrete.—For setting bolts and nuts in a concrete base, a coating of heavy grease applied to the parts which should remain free will prevent the cement from getting a hold on the steel. If it is desired to sink the nut into a machine base, the threads of the bolt should be greased. Then the bolt is free to be withdrawn for mounting the machine. If the grease is thick enough, space for side-play will be left in the concrete, which will allow of easier adjusting for the base of the machine. If it is the bolt that is being sunk, then grease should be applied only to the exposed threads, to keep them clean.—"Power Specialist."

METHODS OF CHARGING FOR GAS.

By J. CAMPBELL, of Dunfermline.

[Paper before the North British Association of Gas Managers at Dumfries on Sept. 8.]

The flat-rate system of charging for gas, though in general use, has become unsatisfactory under present-day conditions, and it would appear to be absolutely necessary that some other system should be adopted by the industry.

The knowledge that discussion of the subject would be acceptable to the Committee of the National Gas Council now dealing with the question, and the fact of having recently advised my Committee to adopt a revised method of charge, induced me to yield to the request of the President for a paper; but the excellent and exhaustive paper on this subject by Mr. McLusky, of Halifax, at last year's Institution Meeting, and the recent publication of the American Gas Association's Manual on "Better Forms of Rates for Gas,"* make it rather difficult to say anything fresh. My contribution, however, will at least give the members of this Association an opportunity of discussing a most important subject.

I think it will be generally accepted that the flat-rate charge does not distribute costs equally among consumers, as by this method many are served below the actual cost of supplying them, while others are paying an undue share of the cost of carrying on the undertaking.

In an endeavour to make the charge to individual consumers, or groups of consumers, approximate more closely to the actual cost to the undertaking of supplying such consumers, American gas undertakings have done much more than we in this country, as is shown by the Reports of a Committee of the American Gas Association over a period of years, and by the number of concerns that have adopted two, three, and four part rates.

A two-part rate consists of a "customer charge" and a "commodity cost;" and a three-part rate includes in addition a "demand charge." I will quote the following definitions employed by the Kansas Public Service Commission.

The Customer Charge consists of the expense of book-keeping, billing, collecting, setting, removing and repairing meters, gratuitous complaint service, office rents, meter reading, and other expenses, and also a part of the fixed charges. The aggregate of these various customer expenses will be identical for all customers, regardless of whether they use gas in small or large amounts, or no gas at all.

The Commodity Cost consists of the items of material and labour, and expenses and repairs directly entering into the production of gas, which are directly proportionate to the volume produced.

A Demand Charge consists of that part of company expense incidental to providing and maintaining the production, transmission, and distribution system of sufficient capacity to render service as required. The principal elements in this cost are the fixed charges, among which are interest, taxes, and depreciation on the necessary plant, and part of the operating and maintenance expenses of the physical property. The "demand charge" is distributed among the customers in proportion to the demand which is contracted for by each customer, and hence in the proportion which each customer contributes towards the creating of the total demand expense.

The following are examples of American gas charges. (All "block" rates refer to *monthly* consumption.)

"A"—NET RATE: $1.00 per 1000 c.ft.

Service Charge: $2.00 per month for first 30 c.ft. of maximum hourly demand, *plus* $1.00 per month for each additional 50 c.ft. or fraction thereof of maximum demand.

Minimum Bill: Service charge as above.

"B"—INDUSTRIAL RATES:

(1) *Customer Charge:* $9.00 per consumer per annum, payable in 12 equal monthly instalments.

(2) *Demand Charge:* $30.00 per 100 c.ft. of maximum hourly demand for the first 3000 c.ft. of demand, $21.00 for excess over 3000 c.ft., payable in 12 equal monthly instalments.

(3) *Consumption Charge:*

70 cents per 1000 c.ft.	for	first	15,000	c.ft.
45 ,,	,,	next	15,000	,,
35 ,,	,,	,,	200,000	,,
29 ,,	,,	over	300,000	,,
25 ,,	,,	,,	1,000,000	,,

"C"—INDUSTRIAL RATES:

(1) *Demand Charge:* $36.00 per year.
(2) *Customer Charge:* $15.00 ,,
(3) *Consumption Charge:* 70 cents per 1000 c.ft.

HOUSE HEATING:

(1) *Demand Charge:* $27.00 per year.
(2) *Customer Charge:* $9.00 ,,
(3) *Consumption Charge:* 50 cents per 1000 c.ft. Subject to 10 p.ct. discount for prompt payment.

Toronto:

First	10,000 c.ft. per month	8½ cents per 100 c.ft.
Next	90,000 ,, ,,	8 ,, ,, ,,
Over	100,000 ,, ,,	7½ ,, ,, ,,

Service charge, 50 cents per month.

*See "JOURNAL" for Aug. 10, p. 326; Aug. 17, p. 396; Aug. 31, p. 497.

The rates charged by public utility companies in America are subject to the approval of the Public Service Commissioners, who, in addition to prescribing the rates to be charged, are required to see that the service rendered is safe, adequate, and reasonable. It is interesting to note that one Public Service Commission thinks that the justice of a "service charge" in making up a rate schedule cannot be questioned, and that the old form of flat rate constituted "a great injustice."

APPLICATION OF AMERICAN SYSTEM.

The question naturally arises as to how far these American charges for "customer" and "demand" could be applied to conditions in this country. So far as my own town is concerned, where the industrial load amounts to only 5 p.ct. of the total output, such charges would, I fear, be impossible. In America, of course, the conditions are different, as the householder has more money to spend on his household requirements. There he will pay for installation and for appliances which in this country would be either hired or supplied free. I understand, however, that in America, even after sanction to a rate has been given by the Commission, there is often serious antagonism on the part of many consumers to the service charge, and that, after such service charge has been accurately determined, it has often, as a matter of policy, to be considerably modified.

It appears to me that in this country we would have strenuous opposition to such charges, and that the better policy would be to have what might be termed a "concealed service charge" in a higher rate per 1000 c.ft. for (say) the first 20,000 c.ft., or other quantity, consumed per annum. Of course, this means raising the rate to a large number of consumers; and therefore the most appropriate time to make such a change would be when gas rates are being reduced.

UNPROFITABLE CONSUMERS.

Within recent months, I have made an investigation of all our consumers' accounts, with a view to framing a new scale of charges; and the result was a revelation as to the number of small and unprofitable consumers supplied by our undertaking. The following is a summary for the year ended May 15, 1926:

Scale of Consumption.	No. of Consumers.	Total Consumption.	Average per Consumer.
		C.Ft.	C.Ft.
Under 5,000 c.ft. per annum. . . .	1194	1,799,200	1,507
Over 5,000 and under 10,000 c.ft.	1203	8,803,600	7,318
,, 10,000 ,, ,, 20,000 ,,	3792	57,783,800	15,238
,, 20,000 ,, ,, 30,000 ,,	2983	73,766,100	24,730
,, 30,000 ,, ,, 50,000 ,,	1961	73,200,200	37,328
,, 50,000 ,, ,, 75,000 ,,	442	26,258,400	59,408
,, 75,000 ,, ,, 100,000 ,,	107	9,127,200	85,301
,, 100,000 ,, ,, 150,000 ,,	89	10,739,000	120,663
,, 150,000 ,, ,, 200,000 ,,	35	5,891,000	168,314
,, 200,000 ,, ,, 250,000 ,,	13	2,908,700	223,746
,, 250,000 ,, ,, 300,000 ,,	14	4,010,500	286,464
,, 300,000 ,, ,, 400,000 ,,	9	3,210,600	356,733
,, 400,000 ,, ,, 500,000 ,,	7	3,052,000	436,000
,, 500,000 ,, ,, 600,000 ,,	2	1,112,700	556,350
,, 600,000 ,, ,, 700,000 ,,	3	2,022,200	674,066
,, 700,000 ,, ,, 800,000 ,,	1	712,400	712,400
,, 800,000 ,, ,, 900,000 ,,	..	..	..
,, 900,000 ,, ,, 1,000,000 ,,	..	..	..
,, 1,000,000	2	3,395,400	1,697,700

It will be observed that we have 1194 consumers who use an average of only 1507 c.ft. per annum, or a total of 1,799,200 c.ft. These 1194 consumers each require a service pipe and a meter, costing on an average (say) £3 per consumer, and involving a capital expenditure of £3582. Against these figures we have one consumer who uses more gas than the whole of these 1194; and in his case the capital outlay only amounts to that necessary to supply one service pipe and one meter—roughly £50. Both groups—that is to say, the 1194 consumers and the one consumer—require practically the same capital expenditure on gas producing plant; and it is therefore evident that the large consumer should get a considerable concession in price, not only because of the above facts, but also because in the one case we have the reading of 1194 meters, and the rendering, collecting, and entering-up of 1194 accounts, against one in the other case.

The expense of our collection department alone, which includes the cost of meter reading, may be taken as strictly proportional to the number of consumers; and in the year referred to these expenses in our case amounted to 2s. 9d. per consumer.

Consumers who used only 1500 c.ft.—value 4s. 3d.—left us only 1s. 6d. to pay for 1500 c.ft. of gas, or 1s. per 1000 c.ft., whereas the consumer who used 1⅜ million c.ft. only cost us 2s. 9d. for collection and meter reading—an infinitesimal amount per 1000 c.ft. If to this sum of 2s. 9d. we add other "customer costs," such as repairing, fixing, and removing meters and stoves, and repair and maintenance of service pipes,

together with a proportion of the salaries and wages of the Distribution Department, and stationery and printing, it will at once be seen how much loss is incurred in supplying these small consumers.

THE "POOR" CONSUMER.

My proposals involved raising the price of gas to small consumers by 4d. per 1000 c.ft.; and, of course, I was met by the plea that we were thereby penalizing the "poor" consumer. But investigation showed that the small consumer is not necessarily "poor;" rather the reverse. In the shopping and central area of our town, the small consumers consist of offices, banks, shops, &c., who only use gas occasionally, and who keep a supply available for emergency only. In many of these cases, the consumption amounted to only a few hundred cubic feet per annum. Of course, there must be some small consumers who are poor, and who must pay more; but if they use only 1500 c.ft. per annum, an increase of 6d. on their yearly gas bill is not deadly, and in any case these small consumers would ultimately benefit if the revised system of charging made for increased consumption per consumer.

Dealing with this point, I find that the American Gas Association Committee on Rate Structure, 1925, state:

> There is still a widespread impression that the small customer—the one using a small quantity of gas per month—is the poor man, the labouring man; or at any rate the impression exists that the small customer is the one who keeps his bill down to the necessities of his purse. As a matter of fact—and it has been demonstrated by investigation—the labouring man and woman are not the small customers, but have bills that are very near the average. It is not the man or woman that must keep down the gas consumption because of the cost that is the small customer, but the one who has little use for gas, and whose circumstances and type of residence are such that he cannot use larger quantities of gas. No doubt there will be occasional poor people in the class of very small customers; but as a class the "small" customers are not identical with our poor people. Why then should it be spoken of as a burden when it is proposed to place the costs upon these small customers?

In any case, the system of giving discounts for larger consumptions is a recognition that the small consumer must pay more.

For the year to May, 1926, our scale of charges was as follows:

2s. 10d. per 1000 c.ft., subject to the undernoted scale of discounts:

Over £10 per annum and under £50	2½ p.ct.
,, £50 ,, ,, ,, ,, £100	5 ,,
,, £100 ,, ,, ,, ,, £200	7½ ,,
,, £200	10 ,,

Industrial Rates:

	s.	d.	
Up to 50,000 c.ft. per annum	2	2	per 1000 c.ft.
Over 50,000 c.ft. and under 100,000 c.ft. per annum	2	1	,, ,,
,, 100,000 ,, ,, ,, 250,000 ,, ,, ,,	2	0	,, ,,
,, 250,000 ,,	1	11	,, ,,

There are several inequalities in the above charges.

1. If a domestic consumer's account is less than £10 per annum (say, 70,000 c.ft.), he gets no concession. Many consumers were, during the past year, entitled to a discount for the first time; but this was due not to increased consumption, but to the increase in price due to the coal stoppage. I am wholly against a discount on money value, as it is evident that a discount of 5 p.ct. on a rate of 2s. 10d. is wholly different from the same rate of discount on a rate of 4s.
2. Under our present "Industrial Scale," there is no minimum consumption before the scale operates. All gas used for such purposes is charged at these low rates, irrespective of the amount of gas used. In the year 1926 we had under this industrial rate 20 consumers who used only an average of 1105 c.ft. per annum, 3 who used only 6666 c.ft., and 22 who used only 13,659 c.ft. per annum each, but who, nevertheless, were entitled to a reduction of 8d. per 1000 c.ft. on these small consumptions. Of our "industrial rate" consumers, 66 p.ct. use only an average of 32,000 c.ft. per annum. Against these we had two domestic consumers who used 289,000 and 379,000 c.ft. respectively—the latter over £50 in value—who paid the full rate.

   The specially low rates to these small "industrial" users cannot be justified.
3. Under the present scale of charges, there is often considerable difficulty in deciding whether a particular customer is entitled to industrial rate. There is no real justification for discrimination in regard to price depending upon the use to which gas is put, and I am strongly of the opinion that rates should depend wholly upon quantity used. There might, however, be cases where the requirements in relation to maximum demand and time of consumption might justify special consideration.
4. Slot meter users at present get no concession, no matter how large their consumption. We have 1246 slot consumers who each use an average of 25,164 c.ft. per annum, 710 who use 37,331 c.ft., 83 who use 57,847 c.ft., 6 who use 82,583 c.ft., and one who uses 111,600 c.ft.
5. The total amount of gas used under our present industrial rate is only equal to 5 p.ct. of our total output, and the majority of consumers in this section get an undue advantage.

The following scale was suggested for the year commencing May 15, but has not yet been accepted by my Committee. It is based on giving all consumers exactly the same terms, and making the price dependent on the quantity consumed, irrespective of the use to which the gas may be put. There would be no differential rate for industrial purposes, and no discounts, and the slot consumers would be on the same scale as ordinary consumers, with the exception that the present additional charge per 1000 c.ft. for slot meters would be maintained.

Proposed Scale.

	s.	d.	
For all gas used up to 24,000 c.ft. per annum	3	2	per 1000 c.ft.
For the next 76,000 ,, ,, ,,	2	6	,, ,,
,, ,, ,, 400,000 ,, ,, ,,	2	1	,, ,,
,, ,, ,, 500,000 ,, ,, ,,	1	10	,, ,,
Balance at.	1	8	,, ,,

In addition, larger meters, kept merely as a stand-by and using only small quantities of gas, to be charged 10s. per annum. (No meter rents are charged.)

Our total number of consumers is 11,860, of whom 4900 are slots and 6960 ordinary; and under the above scale it is estimated that 5670 consumers would benefit by reduced charges, of whom 3403 would be ordinary and 2267 prepayment.

A further analysis of consumers' accounts shows that, of those presently charged under our industrial rate, 50 would be increased to the highest rate, about 100 would pay a slightly increased rate, the larger consumers would pay almost exactly the same as at present, while only two, who use 3,395,000 c.ft. between them, would pay very slightly less. Those who use from 700,000 c.ft. per annum upwards will benefit only by increasing their consumption of gas.

The following are the average prices that would be charged under the above scale:

	s.	d.	
Up to 24,000 c.ft. per annum . . .	3	2	per 1000 c.ft.
For 50,000 ,, ,, ,, . . .	2	9·84	,, ,,
,, 100,000 ,, ,, ,, . . .	2	7·92	,, ,,
,, 200,000 ,, ,, ,, . . .	2	4·46	,, ,,
,, 300,000 ,, ,, ,, . . .	2	3·36	,, ,,
,, 400,000 ,, ,, ,, . . .	2	2·73	,, ,,
,, 500,000 ,, ,, ,, . . .	2	2·38	,, ,,
,, 600,000 ,, ,, ,, . . .	2	1·65	,, ,,
,, 700,000 ,, ,, ,, . . .	2	1·13	,, ,,
,, 800,000 ,, ,, ,, . . .	2	0·74	,, ,,
,, 900,000 ,, ,, ,, . . .	2	0·43	,, ,,
,, 1,000,000 ,, ,, ,, . . .	2	0·19	,, ,,
,, 1,100,000 ,, ,, ,, . . .	1	11·81	,, ,,
,, 1,200,000 ,, ,, ,, . . .	1	11·49	,, ,,
,, 1,300,000 ,, ,, ,, . . .	1	11·22	,, ,,
,, 1,400,000 ,, ,, ,, . . .	1	10·99	,, ,,
,, 1,500,000 ,, ,, ,, . . .	1	10·79	,, ,,

These rates would, it is calculated, bring in almost exactly the same revenue as the old scale of charges.

"CONCEALED" CHARGE.

In the first "block" we really have a "concealed charge" of 4d. per 1000 c.ft., which in the case of those using 24,000 c.ft. per annum amounts to a "service charge" of 8s. per consumer; and it will be noted that even the largest consumers pay this charge. Of course, it must be admitted that the sum of 8s. as a "customer" or "service" charge is inadequate; but it is a step in the right direction, and can be increased by making any further decrease in price effective only on the second and subsequent blocks, or by making the decrease on the first block less than that on the subsequent blocks. There is then the very substantial drop of 8d. per 1000 c.ft. for the next block; and this I consider the most important part of the scale, and one that would be most beneficial in stimulating consumption.

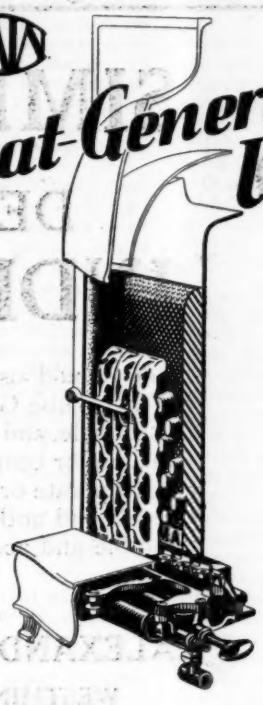
Take the case of a consumer who presently uses approximately 24,000 c.ft. per annum, and who contemplates the installation of a gas fire, or other appliance. He knows definitely that the extra gas used under such a scale would cost him 8d. per 1000 c.ft. less; and this amount is substantial enough to weigh with him in deciding upon extra appliances, while the gas undertaking is saved the cost of installing an extra meter by which to calculate the deductions.

In my opinion, the grading of scales in general use is too fine, as the following examples will show:

		s.	d.	
A.	Up to 10,000 c.ft. per quarter	3	0	per 1000 c.ft.
	Over 10,000 and up to 20,000 per quarter . .	2	11	,, ,,
	,, 20,000 ,, ,, 50,000 ,, ,, . .	2	10	,, ,,
	,, 50,000 ,, ,, 100,000 ,, ,, . .	2	9	,, ,,
	,, 100,000 ,, ,, 250,000 ,, ,, . .	2	8	,, ,,
	,, 250,000 ,, ,, 500,000 ,, ,, . .	2	7	,, ,,
B.	Up to 100,000 c.ft. per quarter	3	2	,, ,,
	100/500,000 ,, ,, ,, ...	3	1	,, ,,
	500/1,000,000 ,, ,, ,, ...	3	0	,, ,,
	1/2,000,000 ,, ,, ,, ...	2	10	,, ,,
C.	Up to 100,000 ,, ,, ,, ...	3	4	,, ,,
	1/500,000 ,, ,, ,, ...	3	3	,, ,,
	500/1,000,000 ,, ,, ,, ...	3	2	,, ,,
	1/1,500,000 ,, ,, ,, ...	3	1	,, ,,

MAIN

Heat-Generating Unit



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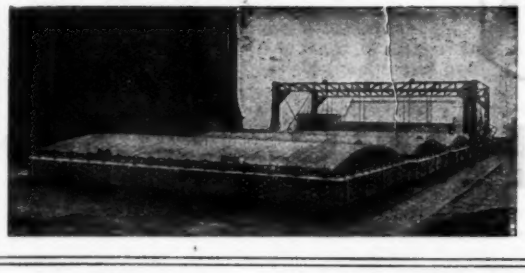

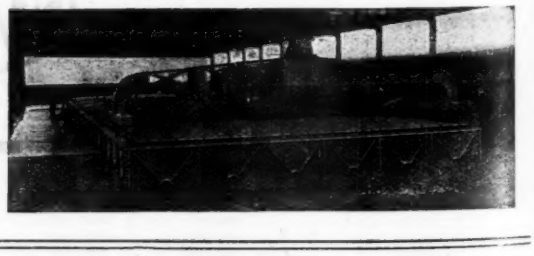

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364

A Simple Method.

I would ask if there is any real inducement under these scales for either the domestic or the industrial consumer to increase his consumption. Is 1d. per 1000 c.ft. sufficient reduction for a consumption of half-a-million per quarter? I am afraid not; and it appears to me to be the correct method to raise the base, or existing flat rate, by a few pence per 1000 c.ft., and thereafter to make substantial concessions to those who use more than the existing average consumption per consumer per annum. This method has the advantage that it is exceedingly simple, can be applied equally to ordinary and slot consumers (from the latter there would be a difficulty in collecting a fixed charge), and, further, it does not require any detailed and involved explanation to consumers.

In America, it was found necessary to adopt publicity campaigns explaining the necessity of having two or three part charges, before these were put into operation; and the same thing would apply to this country. While the industry might be perfectly convinced of the justice and fairness of a two-part rate, there is always the danger that consumers would look upon the change as only another method of extracting money. Of course, we pay for our telephones by the same method; and, if I remember aright, the Post Office did a considerable amount of publicity work before they made the change. There is now no objection to this method of charge, though there were complaints at first from those who had previously been supplied below cost. The same thing would apply to consumers who used small quantities of gas. For this reason I would be against making the system optional, as by this means the existing unprofitable consumers would continue under the flat rate, and the main object of the change in rates would be defeated. Of course, we can never hope entirely to eliminate unprofitable consumers; but their number can be materially reduced.

Toronto claims as a result of a two-part rate that whereas in 1920 there were 62 p.ct. of non-profitable consumers, there are now only 10 p.ct.

As to whether municipalities in Scotland, acting under the Burghs Gas Supply (Scotland) Act, would have power to frame rates in accordance with these suggestions, I am advised that the "like circumstance" clause would fully cover any objections that might be raised.

To frame new rates that could be substantiated as really sound, means most careful analysis of working costs, and possibly, in many cases, alterations to present methods of dissecting accounts, so that costs "per consumer" and costs applicable to every thousand made, &c., could be ascertained.

I do not propose to enter into any details as to how this should be done, but would just say a word as to what should be the lowest figure on the scale. This should at least cover the cost of "gas into holder," *plus* capital charges, so far as can be ascertained, for distribution to an average large user of gas. While this may be considered as being unduly low, it must be remembered that under our proposed scale these large consumers pay higher figures for their initial consumption, thereby raising the average price paid. Circumstances, however, might arise where the loss of an existing large consumer would considerably affect working costs; and such cases would require to have special consideration, resulting in a price determined more from policy than in accordance with costs.

One thing is certain—that no hard and fast rule or rules can be laid down, as the circumstances of each undertaking vary so widely. However, it can be assumed that the National Gas Council Committee will be able to give guidance as to the general lines on which rates should be based.

Effect of New Charges on Gas Consumption.

The question may be asked as to what effect such charges would have on gas consumption; and for answer I would again quote American experience, more especially as it deals with a gas undertaking which has to encounter the strongest possible competition from electricity.

In Chicago, in 1896, the *per capita* use of electricity amounted to 8 KW.H., whereas in 1925 the corresponding figure was 922 KW.H. The sales of gas in that period increased from 7426 millions to 32,501 millions; and while the population between 1910 and 1924 increased by 34 p.ct., the gas consumption increased by 72·5 p.ct.

According to Chicago, these results could not have been accomplished with a flat rate for gas, but only by a revised method of charge which enabled them to meet the competition with which they were faced.

In conclusion, I would quote the statement of Mr. Hewitt, of Toronto, in discussing the paper by Mr. W. B. McLusky at last year's Institution Meeting.

"No matter what you may think of it to-day, this problem is one which you will be forced to deal with very soon, whether you want it or not. You will not be able to continue business without some change in the present form of charge to the consumer."

[The discussion on Mr. Campbell's paper will be published in next week's "JOURNAL."]

GAS BLENDING.

By ROBERT STURROCK, of Ardrossan.

[Paper before the North British Association of Gas Managers at Dumfries on Sept. 8.]

In presenting this paper to you for your consideration, I trust that it will prove of interest to the majority of the members present who are in charge of undertakings similar in size to that in which I have the honour of serving.

The Ardrossan Works.

The Ardrossan Gas-Works were erected on the present site at Stanley in the year 1903, at an initial cost of £20,000 or thereabouts. The annual output of gas from the works at that time was 24 million c.ft. To-day the output has increased to 44 million c.ft. The present carbonizing plant consists of six ovens of horizontal retorts, each set in beds of sixes; the dimensions of the retorts being 22 in. by 15 in. by 9 ft. in length, and of Ω shape. The centre retorts in certain ovens are of sectional silica, and the sides of fireclay. This has proved a very satisfactory and economical arrangement. Within the past three years the whole of the ovens have been reconstructed by Messrs. R. S. & B. C. Workman, of Saltcoats, on their well-known semi-regenerative principle; and provision has been made for a further two beds of similar dimensions, should it be deemed necessary to extend the carbonizing plant at any time. Other parts of the manufacturing and purification plant are of ample capacity, and are capable of dealing with an annual output of three times the present. There are two gasholders—one 200,000 c.ft. and the other 60,000 c.ft.

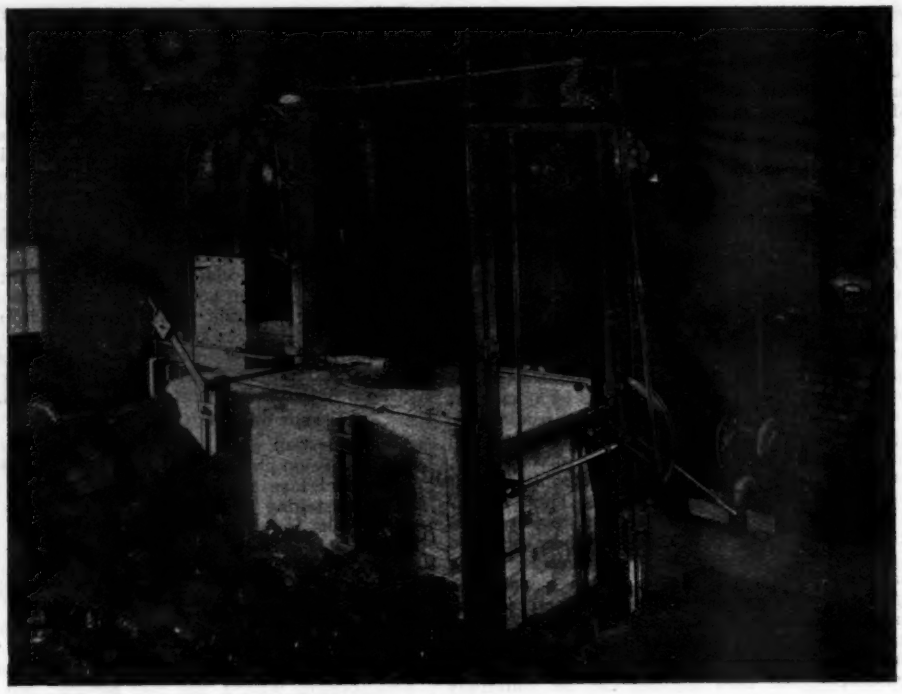
In the year 1913 a sulphate of ammonia plant was introduced capable of producing 1 ton of sulphate per 24 hours; and in 1919 a tar dehydrating plant was erected of a capacity sufficient to produce 500 gallons of refined tar per 24 hours. Two years ago a "Simplex" water gas plant was installed of a rated capacity of 75,000 c.ft. per 24 hours; and it is mainly with the blending of this gas with the straight gas produced from the horizontal settings that I intend to deal.

A "Testing" Period.

When I took over the management of the Ardrossan Works a little over three years ago, I was faced with the proposition as to what grade of gas was going to be the most serviceable and economical to supply, with a view to ultimately declaring a uniform calorific value under the Gas Regulation Act, 1920. After carrying through a series of tests on the works and on the district, and having satisfied ourselves that with the maximum load on our mains we could maintain a minimum pressure of 30-tenths at the extreme end of the town, we decided that, if it were possible to produce a uniform calorific value of 440 to 450 B.Th.U. per c.ft., it would meet our consumers' requirements admirably. The question now was: "How could this be accomplished?"

We decided that a reliable means of determining exactly what was the calorific value of the gas being made was necessary; and a Boys water flow calorimeter was therefore installed. Might I mention here that I consider this instrument is a necessity in all sizes of works? I appreciate that expenditure in this direction in smaller works may of necessity be restricted; but I am confident that the results obtained from the knowledge it imparts, if properly applied, will in a very short period of time more than clear the initial expenditure. No engineer and manager can come confidently forward and state what his thermal production is, unless he has a reliable means of determining daily what the calorific value of the gas is that he is producing. Occasional tests on a recording instrument against a standard calorimeter are not sufficient to give one the necessary confidence in their results.

Having installed the calorimeter, and ascertained exactly what quality of gas was being produced, we then considered what means to adopt to obtain a uniform grade of 450 B.Th.U. gas. A make of approximately 10,000 c.ft. per ton of 550 B.Th.U. gas was being obtained; but how was this legitimately going to be reduced to the desired 450 B.Th.U.? I considered three alternatives. First, it was possible, by overpulling, to reduce the quality of the gas and increase the make per ton, but with a corresponding increase in the inerts, which I knew was bound to assist in the formation of cyanogen owing to the high percentage of both carbon dioxide and nitrogen in the resultant gas, and which in time could only result in acute corrosion taking place in the services, the destruction of the diaphragms of the meters, and increased expenditure therewith. We therefore decided that, though this practice would enable us to reduce our value to the desired 450 B.Th.U., it was not desirable. Secondly, we considered



THE "SIMPLEX" WATER-GAS PLANT.

the possibility of introducing steam into the retorts. After extended trials, we came to the conclusion that this method was not feasible; and we had therefore to consider some other means of obtaining our desired quality.

INTRODUCTION OF THE "SIMPLEX" C.W.G. PLANT.

We then considered the possibility of introducing water gas in some form or other; and after having inspected various types of water gas plants, we finally decided that the "Simplex" was the most suitable and economical for our particular requirements. The plant consists of a silica brick generator; the dimensions being 5 ft. 7½ in. by 2 ft. 7½ in. by 12 ft. deep, and the thickness of the walls 18 in. The latter are supported and tied together by buckstays. The plant is provided with hydraulic main, anti-dip and seal valves, and a carburetting chamber, whereby the gas can be enriched by the introduction of either tar or oil, if required. We have not, however, found it necessary to carburet. The air is admitted at the base of the generator during the blow period, and is supplied by a Sturtevant No. 1 fan driven by a 2½ B.H.P. steam turbine, which has a speed of 4400 R.P.M. A sectional plan of the plant is shown on p. 623 so that the above description may be more easily followed.

The cycle on which we operate the plant is 6 minutes "blow" and 20 minutes "run." The generator is pricked-up, cleaned, and filled every four hours. As will be observed, the plant is fitted-up with the well-known "Sydenham" grate, with the object of preventing clinkering troubles. In its two years' work at Ardrossan, I am glad to say we never have had any signs of clinkering in the generator; and no earlier than two months ago we purposely put off the plant and emptied the generator so that we might have an opportunity of giving it a thorough inspection. We found that the inside brickwork was in as good condition as on the day we commenced operations. This was all the more remarkable when we considered the varying qualities of coke which had passed through it within the past year, particularly during the period of the coal stoppage.

Now I will readily admit that the cycle on which we operate the plant—namely, 6 minutes blow and 20 minutes run—will at once lend itself to severe criticism. It was one of the features of the plant of which I myself was wary when I had it under consideration. But I am confident that the quality of the blue gas produced is in itself sufficient to justify this procedure. This cycle, especially in a small works similar in size to our own (and there are at least 80 works in Scotland which come within this category), is of paramount importance, and has a great bearing on the labour charges per 1000 c.ft. of gas produced. The stoker on duty can find time to attend to other matters about the works while the plant is on the "run;" there is therefore no necessity for having an attendant standing beside the plant continually when it is in operation.

ADVANTAGES OF THE "BLEND."

Briefly the advantages we have derived from the installing of the plant may be summarized as follows:

(1) Being able to produce a gas of 450 B.Th.U., or thereabouts, with low percentage of inerts.
(2) Saving in annual repairs and renewals to retorts.
(3) Saving in labour charges.
(4) Facilities for manufacturing cheaper gas. Low capital cost of installation.

I might mention, further, that under heading (3) there is also less labour necessary for coal handling, since, owing to the increased yield of gas per ton of coal carbonized, less coal is handled. With regard to coke, we are now in the position of having little or no coke available for sale outside our local requirements. Here again an additional saving in labour is effected, and a better price obtained for coke than would otherwise have been the case. Owing to the fact that all our coke is now sold locally, and taken away by road, the charges previously incurred in loading the coke into railway wagons are obviated. I might also mention here that with this particular type of plant there is no necessity for providing a relief holder; the "blue" gas from the plant being mixed in the foul main with the "straight" gas from the retorts, and the mixed gas then going through the purifying plant. The average quantity of coke used per 1000 c.ft. of blue gas produced is 45 lbs.; and on an average 50,000 c.ft. of blue gas is produced per ton of coke used.

IMPORTANCE OF BLENDING COALS.

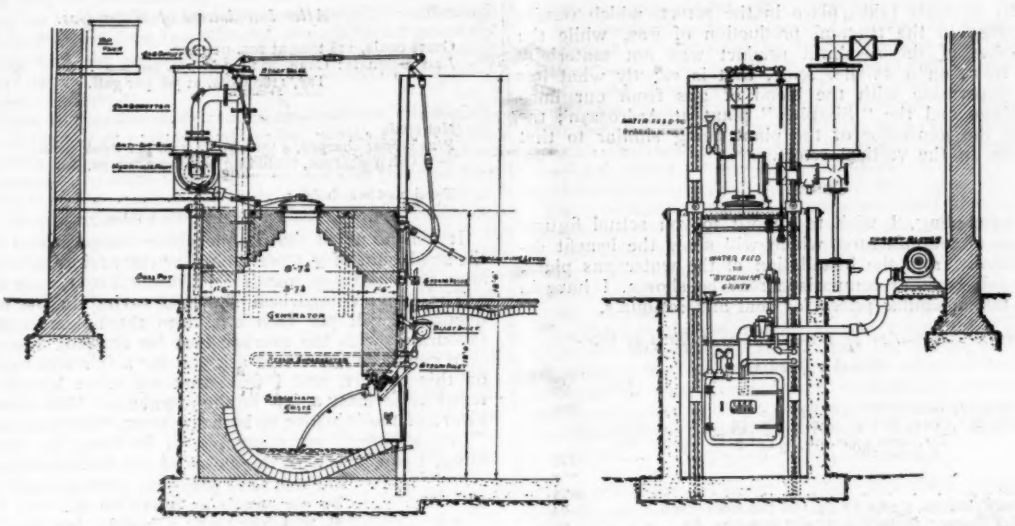
Before submitting results of tests we have carried out in connection with the plant, let me state that I consider it not only of importance to have a uniform "blend" of gas, but it is of equal importance to "blend" the coals being carbonized. In our own case we have carried through a number of tests on various grades and classes of coal. In all, 32 coals have been tested under similar conditions within the past two years. We ultimately decided on 5 grades which had given us the best results; and I submit herewith the average analyses of these.

—	Coal A.	Coal B.	Coal C.	Treble Nut D.	Treble Nut E.
Moisture, p.ct.	4·0	5·2	7·6	4·5	6·6
Volatile matter, p.ct.	35·4	34·4	33·5	36·4	35·0
Fixed carbon, p.ct.	57·9	56·4	55·5	56·1	55·6
Ash, p.ct.	2·7	4·0	3·4	3·0	2·8
	100·0	100·0	100·0	100·0	100·0

Average composition of coke produced from:

	Coals A and B.		Coal C and Nuts D and E.
Volatile matter, p.ct.	2·8	..	0·9
Fixed carbon, p.ct.	91·0	..	90·8
Ash, p.ct.	6·2	..	8·3
	100·0	..	100·0
Moisture, p.ct.	14·5	..	1·4

The coke produced from Coals A and B is used exclusively in the water gas plant, while those made from Coal C and the Treble Nuts D and E are employed in the producers, the surplus going to the yard.



SECTION AND ELEVATION OF THE "SIMPLEX" GENERATOR.

Another important item in the resultant blend of gas is the system of charging adopted. We found over a 6 weeks' test using the above coals that 4 to 5 hours' charging produced the following results.

RESULTS OF A SIX WEEKS' TEST.

Average temperature in combustion chamber of retort bench during period of test	2030° Fahr.
Average temperature in retort during period of test	1650° Fahr.

Average Analysis of Straight Coal Gas Produced.

	P.Ct.
Carbon dioxide	3·2
Heavy hydrocarbons	2·8
Oxygen	0·2
Carbon monoxide	6·6
Methane	29·1
Hydrogen	54·2
Nitrogen	3·9
	100·0
Gross calorific value	561 B.Th.U. per c.ft.
Net " "	504 " "

Average Analysis of Blue Gas 5 Minutes after "Run" has Commenced.

	P.Ct.
Carbon dioxide	6·8
Heavy hydrocarbons	*Nil*
Oxygen	0·8
Carbon monoxide	33·0
Methane	1·58
Hydrogen	47·52
Nitrogen	10·30
	100·00
Gross calorific value	282 B.Th.U. per c.ft.
Net " "	252 " "

Average Analysis of Blue Gas 10 Minutes after "Run" has Commenced.

	P.Ct.
Carbon dioxide	8·2
Heavy hydrocarbons	*Nil*
Oxygen	0·2
Carbon monoxide	33·8
Methane	1·54
Hydrogen	50·95
Nitrogen	5·31
	100·00
Gross calorific value	295 B.Th.U. per c.ft.
Net " "	266 " "

Average Analysis of Blue Gas 15 Minutes after "Run" has Commenced.

	P.Ct.
Carbon dioxide	8·2
Heavy hydrocarbons	*Nil*
Oxygen	0·6
Carbon monoxide	31·8
Methane	1·19
Hydrogen	53·06
Nitrogen	5·15
	100·00
Gross calorific value	292 B.Th.U. per c.ft.
Net " "	264 " "

Average Analysis of Mixed Gas Produced.

	P.Ct.
Carbon dioxide	7·0
Heavy hydrocarbons	2·4
Oxygen	0·2
Carbon monoxide	14·4
Methane	19·2
Hydrogen	49·2
Nitrogen	7·6
	100·0
Gross calorific value	448 B.Th.U. per c.ft.
Net " "	403 " "

Gas produced per ton of coal carbonized	17,505 c.ft.
Calorific value of gas produced	446 B.Th.U. per c.ft.
Therms produced per ton of coal carbonized	78·1
Coke available for sale per ton of coal carbonized	4·8 cwt.
Tar produced per ton of coal carbonized	11·8 galls.

It will be observed from the results of the water gas analysis that as the run progresses, the carbon monoxide content is diminished, and also the methane content; while the hydrogen content gradually increases. This is generally accepted as good practice. The calorific value increases for the first ten minutes of the run, and then gradually falls again. I am confident that these results compare favourably with any that can be obtained with any type of plant which is suitable for installing in a small works.

The analysis of the gas was carried through on a Hempel gas analysis apparatus; the solutions being standardized from time to time during the test. The temperatures were taken with a Féry optical pyrometer. I should mention that the analysis of the gas taken during the test compares favourably with the average obtained during the past two years; the analysis being carried through in ordinary routine once each week.

A YEAR'S WORKING RESULTS.

As a comparison with the above figures, I append herewith the results obtained in the past year's working:

Total gas made	44,289,500 c.ft.
Accounted for	42,029,900 c.ft.
Loss	2,259,600 c.ft.
Leakage	5·10 p.ct.
Coal carbonized	2,587 tons
Gas made per ton of coal carbonized	17,120 c.ft.
Gas sold " " "	16,247 c.ft.
Calorific value of gas made	439 B.Th.U. per c.ft.
Therms produced per ton of coal carbonized	75·1

It will be noted that the average calorific value for the year is slightly below the normal; but this is accounted for by the fact that, during the latter part of the coal strike period, the quality of gas produced was lower than the quality supplied normally, owing to the class of coal obtainable and the then prevailing conditions.

A COMPARISON.

I find it interesting to compare the results produced from the water gas plant with those obtained by the application of steam to intermittent vertical retorts. Going back some five years, I carried through a test on the Wilson "Glasgow" intermittent vertical retorts, under the direction and supervision of my esteemed Chief, Mr. John K. Frazer, Manager of the Dalmarnock Gas-Works, Glasgow. The results of these tests disclosed the fact that, by the judicious application of steam to the vertical retorts, a reaction involving the C,

H_2, and N_2 contents takes place in the retort, which results in an increase in the thermal production of gas, while the calorific value of the resultant product was not materially affected. Now, on a smaller scale, that is exactly what has been our experience with the blend of gas from our horizontal settings and the "Simplex" plant at Ardrossan; the reaction in the generator of the plant being similar to that taking place in the vertical retort.

Costs.

Before concluding, I wish to submit to you actual figures of the costs of manufacture, which will show the benefit derived financially from the installation of the water gas plant. So that a fair basis of comparison may be shown, I have in each case taken similar prices for coal and residuals.

Prior to Introduction of Water Gas on a Basis of One Month's Working.

	£	£
Gross coals, 200 tons at 20s. per ton		200
Less residuals: Coke, 80 tons at 25s. per ton	100	
Tar, 2000 galls. at 3d. per gall.	25	
		125
Net coals		75
Plus labour charges, 6 men at £3 10s. per week each		84
Other charges, including repairs to works, &c.		50
Total cost into holder		£209

Cost per 1000 c.ft. into holder, 2s. 1d.

After Introduction of Water Gas.

	£ s.	£
Gross coals, 118 tons at 20s. per ton		118
Less residuals: Coke, 30 tons at 25s. per ton	37 10	
Tar, 1180 galls. at 3d. per gall.	14 10	
		52
Net coals		66
Plus labour charges, 4 men at £3 10s. per week each		56
Other charges, including repairs to works, &c.		45
Total cost into holder		£167

Cost per 1000 c.ft. into holder, 1s. 6d.

It will be noted that in the above comparison I have taken the small sum of £5 per month as the saving in works repairs after the plant was installed. This is a minimum figure.

The above comparison shows a saving in the cost of production of 7d. per 1000 c.ft. into the holder, and compares favourably with the average cost for the past two years.

In conclusion, I would ask you for a fair and free discussion on this subject, and I trust that my effort has proved of interest to at least a few of the members. Undoubtedly all are aware of the injustice to both the consumers and themselves of "over-pulling;" yet many persist in doing it. With that in mind, I conclude with the words of our National Bard—

Oh wad some power the giftie gie us
To see oursels as others see us!
It wad frae mony a blunder free us,
And foolish notion!

[The discussion on this paper will be published in the next issue of the "JOURNAL."]

MEETING OF THE BRITISH ASSOCIATION.

DISCUSSION ON COAL.

In last week's "JOURNAL"—pp. 547-50—we gave the first part of a discussion on coal which took place at the Leeds meeting on Friday, Sept. 2. To-day we complete this portion of the proceedings; leaving over some miscellaneous items for notice subsequently.

CHEMISTRY OF COAL.

By Prof. R. V. WHEELER.

Dr. F. V. TIDESWELL presented a paper prepared by Prof. R. V. Wheeler reviewing recent work on this subject. The author said some years ago Dr. Marie Stopes and himself had suggested that, in view of the number and apparent complexity of the plant materials that had contributed to its formation, the rational mode of study of coal would be to determine separately the character of the contribution made by each of the more important individual coal-forming materials of plants. At the meeting of the British Association at Newcastle-on-Tyne, in 1916, they had outlined the programme of research they proposed to follow. Such a mode of attack had of necessity taken a long time to develop; and it had not yet yielded all the results desired. Nevertheless the work had reached a stage at which a review of progress could profitably be made. This paper was intended to present such a review.

COAL-FORMING MATERIALS.

The various plant entities and residues that had contributed to the formation of the organic substances of coal could conveniently be grouped according as they were:

(1) *Resistant to Decay.*—Among the more important members of this group were (*a*) spore-exines and cuticular tissues; and (*b*) resins.
(2) *Subject to Decay.*—The members of this group were either (*a*) organized, such as cellulosic and lignified tissues; or (*b*) amorphous, the contents of plant cells.
(3) *Products of Decay.*—The ulmins.

In a deposit of the age of coal it could not be expected that the materials of any of the three groups would remain unaltered. It was to be expected that, chemically, coal would be divisible into two main groups of substances differing considerably from each other—the one composed of the resistant plant materials, perhaps in a somewhat changed form; the other, the ulmins derived from the less resistant cellular structures and cell-contents. It had been suggested that a third specific group, of nitrogenous substances, should also be present; but no evidence of such a group had been obtained, and it appeared that the nitrogenous compounds in plants contributed, as the result of chemical combination, to the ulmin group.

By whatever means the constitution of coal was studied, evidence was obtained of the presence, not of an indefinable mass of chemically heterogeneous débris, but of only a few well-defined types of materials. The general nature of coal was best shown, however, by its behaviour under mild but prolonged oxidation, which converted bituminous coals partially or almost wholly, according to their nature, into alkali-soluble substances, leaving a residue that varied in amount and in character according to the character of the coal. This residue was composed mainly of spore-exines, with some cuticles, resins, and particularly resistant woody tissues (including fusain), representatives of the non-ulmified resistant plant materials—one of the two major groups of coal constituents. These resistant materials had retained their morphological structures, and, to a large extent, their chemical characteristics, throughout the process of coalification.

The alkali-soluble material was derived from the other main group of constituents of bituminous coal—the coal-ulmins. The coal-ulmins were themselves insoluble in alkalis, but oxidation rendered them soluble, presumably by reason of replacement of some of the external groupings of the molecules by carboxyl. The alkali-soluble ulmins produced from a bituminous coal on oxidation were definite types of compounds, not mixtures of dissimilar types, which attained a nearly constant composition (C, 62·65; H, 2·5 – 3; O, 32 – 35; N, 1 – 2 p.c.) when the oxidation had been carried sufficiently far, whether the portion of a coal from which they were obtained be vitrain, clarain, or durain. This uniformity of product was evidence of the uniformity in character of the material from which it was derived—namely, the insoluble coal-ulmin which formed the bulk of most coals. Moreover, the composition of the alkali-soluble ulmins produced on the oxidation of coals remained constant over a wide range of coals of different rank, indicating the presence of a similar type of material throughout such a range of coals.

Actually, the coals differed as regarded the ease with which alkali-soluble ulmins were produced from them; and it was probable that the differences in rank of coals were mainly due to modifications in the readily oxidizable and replaceable external groupings of the coal-ulmin molecules. The most obvious example of a difference of this nature was obtained on comparing peat with bituminous coal. The ulmins as they existed in peat were soluble in alkalis; but they possessed a similar nuclear structure to that of the coal-ulmins, which had undoubtedly been derived from materials akin to the peat-ulmins. The loss of solubility in alkalis which differentiated the peat-ulmins from the coal-ulmins was the first of the changes indicated in the changing rank of coals. The ready separation of the coal-ulmins from the resistant plant débris permitted a rational analysis to be made of coals.

After discussing the chemistry of the coal-ulmins and resistant plant remains, and the extraction of coal by solvents, Prof. Wheeler dealt with the distillation and oxidation of coal.

DISTILLATION OF COAL.

When attempting to deduce the character of coal from its behaviour on heating and from the products of its distillation, two main difficulties were encountered. Coal being a heterogeneous substance, the effects observed when it was heated might be compounded of the effects produced by each ingredient independently; while the primary products of distillation might be subject to secondary decomposition. The latter difficulty could largely be overcome by adopting suitable measures to remove the primary products of decomposition, at carefully regulated stages, as rapidly as they were formed. Valuable

information had been obtained in this way. Destructive distillation of coal *en masse*, however, failed to disclose the individual contributions of the various constituents, though broad generalizations could be made regarding the character of the types of compounds responsible for the major effects—obvious stages of decomposition—observed.

Thus, at low temperatures there was an evolution, almost exclusively, of oxides of carbon and water, which, by analogy with the behaviour of carbohydrates on destructive distillation, had been assumed to come from those portions of the coal that were derived from the various celluloses. At moderate temperatures the decomposition products were mainly hydrocarbons, both liquid and gaseous, such as might be yielded by "resinic" material. At high temperatures the products were mainly hydrogen and the oxides of carbon, from the "cellulosic" portion of the coal. These suggestions had received support from the results of distillations of the several fractions into which coal could be separated by means of solvents.

Knowledge of the individual contributions of the various constituents of coal towards its distillation products could, however, best be obtained (*a*) by the separate distillation of such individual substances as could be isolated—*e.g.*, resins and hydrocarbons (by solvent extraction), and spore-exines and cuticles (by oxidation and treatment with alkalis); (*b*) by comparison of the results so obtained with the results of distillation of modern plant materials of a similar nature; and (*c*) by a suitable choice of coals for destructive distillation—*e.g.*, the components of a banded bituminous coal, or coals in which one or other ingredient was known to be concentrated in abnormal amount. The information obtained by these means could be summarized as follows:

The Ulmins.

The ulmin constituent could not be separated from bituminous coal without modifying its character. Perhaps the nearest approach to a pure coal-ulmin was a vitrain from which all resinous and hydrocarbon material had been removed by extraction with solvents. Peat-ulmins could readily be isolated; and their behaviour on distillation could be compared with that of extracted vitrains and oxidized ulmins prepared from them.

Peat-ulmins on distillation yielded much water and a little phenolic tar, with, at higher temperatures, a large volume of gases, mainly hydrogen and the oxides of carbon. This behaviour was typical of the natural ulmins, whatever their source. It was shown, also, by the synthetic ulmins (containing nitrogen) yielded by the interaction of amino-acids and carbohydrates. These so-called "amino-ulmins" were of considerable interest, not only because of their general similarity in composition and behaviour with the natural ulmins, but because they were derived from materials which occurred among decayed and decaying plant accumulations, and were formed under conditions which could occur in Nature.

The products of distillation of a vitrain closely resembled those of a peat-ulmin; the main difference—a smaller yield of water and carbon dioxide—being attributable to loss of hydroxyl, carboxyl, and other external groupings during the change in rank of the ulmin from that of peat to that of bituminous coal. The oxidized ulmins prepared from a vitrain yielded greatly increased quantities of carbon dioxide (owing to the introduction of carboxyl groups); but the products of distillation, carbon monoxide and hydrogen at high temperatures, and a phenolic tar, were otherwise characteristic of ulmins in general. As the ulmin constituent changed in rank with the carbon content of the coal, the products of distillation contained lesser quantities of water and oxides of carbon.

The Resistant Plant Remains.

Spore-exines and cuticles yielded between 40 and 60 p.ct. by weight of liquid hydrocarbons. Resins partly distilled unchanged, and partly decomposed, yielding gases (mainly paraffin hydrocarbons) and up to about 50 p.ct. by weight of hydrocarbon tars. The resins extracted from coal (or separated from it mechanically) behaved similarly to such fossil resins as had been examined. The hydrocarbons isolated from coal distilled unchanged.

By close observation of the course of the distillation of a bituminous coal, it was possible to detect the independent decomposition of each of the ingredients. For example, the early distillation without change (liquation) of the hydrocarbons, the later decomposition of the resins, and the main decomposition of the ulmin constituent.

In general, therefore, it could be said that, when a bituminous coal was distilled, the phenolic tars, water, oxides of carbon, and hydrogen produced were derived from the ulmin constituent. Gaseous hydrocarbons were derived in part from the ulmin constituent, and in part from the resistant plant remains. Liquid hydrocarbons were yielded mainly by the plant remains.

Oxidation of Coal.

From early work the presence in coal of two main types of constituents had been deduced—the one "reactive," the other relatively "inert." It was demonstrated that the difference, chemically, between the vitrain, clarain, durain, and fusain of a banded bituminous coal lay in the proportions of "inert" material with which the "reactive" material in each was associated; the latter being of the same chemical composition throughout the banded coal. The later work on the oxidation of coal specified as the "reactive" group of compounds those that could be converted by mild oxidation into alkali-soluble ulmins; and as the "inert," those that remained insoluble in alkalis—the plant remains. The "reactivity" of the ulmin constituent of coal, as contrasted with the "inertness" of the plant remains, was displayed not only by its oxidizability, but by its behaviour towards reagents in general—its response to the dispersive action of pyridine and to the action of heat, more particularly as regarded the production of gases on distillation.

The mechanism of the atmospheric oxidation of the coal-ulmins seemed to be, in sequence, (*a*) the adsorption of oxygen on the colloidal material, (*b*) the addition of oxygen to the external groupings of the molecule, and (*c*) the splitting-off of external groupings and their replacement by carboxyl. Attack on the nucleus of the coal-ulmin did not begin until more vigorous oxidation than atmospheric was employed. The oxidizability of a coal thus depended upon the nature of the external grouping of the ulmin molecules. The effect of the progressive condensation and elimination of external groupings from the ulmin molecules as coals progressed in rank was seen in their gradual decrease in oxidizability.

General Considerations.

The materials, all forms of plant structures, that might have contributed to the composition of coal were numerous and diverse in character. Except for certain specific substances, too small in amount to require consideration here, these materials were, however, substantially the same in chemical nature, though varying widely in form and in the relative quantities present, whatever the type of plant life to which they belonged. The relative amounts of the different plant materials that ultimately formed coal might be considerably altered by the conditions of their accumulation in the coal-forming beds. For example, there would be a tendency for the heavier woody matter, containing much lignin and cellulose, to be segregated from the lighter débris, such as spores and pollens, so that the resulting coal might show local enrichments of such bodies.

Local contributions of different plant materials accounted for the commonly banded appearance of bituminous coals. The differentiation of such banded coals into physically distinct components—vitrain, clarain, durain, and fusain—enabled a study to be made of the extent to which local enrichments affected the properties of coals; for these components of banded bituminous coals differed from one another almost entirely because of the different contributions made to them by the various parts of plants. For a proper understanding of the character of bituminous coal, it was, in fact, essential to study each physically distinct banded component separately.

As a result of numerous researches on banded bituminous coals, it had become increasingly apparent that the great complexity of character of the initial coal-forming materials had not been transmitted to the resulting coal. During the process of coalification, and, as it would appear, mainly during the initial stages—those of decay of the vegetable matter—many of the more important components (in quantity) of the accumulated plant material lost their identity, and by extensive alteration and interaction found common level as "ulmin compounds." These ulmins formed a definite class of compounds, not necessarily homogeneous, but probably comprising several distinct types, yet sufficiently alike in their chemical constitution and behaviour to justify their being grouped under one head. So far, no separation of the naturally-occurring ulmins into markedly different classes of compounds had been obtained experimentally.

The plant materials which contributed to the ulmin group of compounds were the structural portions, the lignin and celluloses of the cellular framework, together with much of the cell contents—namely, carbohydrates and proteins. These materials formed the bulk of the plants, and the resulting ulmins formed the bulk of coal. The predominance of ulmins was already apparent in an accumulation of plant débris after a comparatively short process of decay—*e.g.*, in peats, in which alkali-soluble ulmins were found in increasing amounts as the age of the peat increased. The ulmins, as first formed, were not permanent, unchangeable compounds, but were subject to progressive alteration according to the conditions to which they were subjected. Their progressive alteration became most apparent in a decrease of solubility in alkalis, partial in the lignites, complete in bituminous coals. Over the whole range of coals, also, the ulmins progressively altered, more particularly as regarded their ease of oxidation, as the rank of the coal increased. There was good reason for the belief that the rank of a coal was determined mainly by the change that had taken place (by such factors as pressure, temperature, and time) in the ulmins it contained.

The parts of plants which did not undergo decay, with the formation of ulmins, were the protective coverings of plant tissues, such as the coats or exines of spores and the cuticles of stems and leaves, together with certain special plant products, such as the resins. These were not readily subject to decay, nor were they readily altered by the conditions attending coalification; so that they were found in coal but slightly modified from their original forms, and in quantity greater than corre-

sponded with their original proportions in the plant débris. There were also present in coal small quantities of free hydrocarbons, probably derived from the oils and waxes of the plants during the processes of decay and coalification. These three classes of plant materials, protective tissues, resins, and hydrocarbons, though different in character, could conveniently be grouped together as "resistant plant remains."

A normal coal could be regarded as essentially a mixture of the two groups of compounds, ulmins and resistant plant remains. It could confidently be anticipated, as the result of work now in progress, that the nature of any coal could be related to (*a*) the character of its ulmin compounds and (*b*) the contents and nature of its resistant plant remains, so that a rational classification could be obtained. There seemed to be no possibility of compounding the influence of these two groups of materials, for their effects on the character of the coal composed of them were independent.

At present our knowledge of the extent to which each of these main component groups of compounds affected the behaviour of coal under different conditions was incomplete; but it was possible to relate one or other property broadly to the presence of one or other component. For example, in those reactions of coal which involved its oxidation the ulmin compounds played the major part; while the behaviour of coal on destructive distillation as regarded its yield of tar was determined mainly by its contents of resistant plant remains. The "coking power" of a coal depended on too many factors to permit of its being related so simply to the presence of some coking ingredient. Nevertheless, it should be possible to deduce the coking properties of a coal from its chemical constitution. The resins, and to a certain extent the hydrocarbons, appeared to play the part of agglutinating materials; but it was clear that the character of the infusible part of the coal was of equal importance.

There was no question that the most economic use of coal was hampered by lack of definite knowledge of its chemical nature. It was significant that, of the various schemes suggested for obtaining oil from coal, the one regarded by many as the most promising involved the complete breakdown of the coal molecules, with the formation of carbon monoxide and hydrogen from which oils were laboriously re-synthesized. With the more complete knowledge, rapidly being attained, of the chemistry of the major components of coal, it was not too much to hope that direct advantage might be taken of their properties to put them to the use for which they were best suited.

[Details of the researches referred to by Prof. Wheeler are given in a series of papers in the "Journal of the Chemical Society."]

Discussion.

Dr. A. PARKER said that Dr. Lander had quite rightly emphasized the need for more fundamental work being done and for less empiricism. The difficulty, however, was to decide what was fundamental work and what was empiricism, because it was not easy to do so when dealing with a substance like coal, which he personally would not like to describe as a chemical compound or a mixture of chemical compounds. In the early days of chemistry, they looked upon a compound as being a combination of two or more elements which were so strongly attracted to each other that there was difficulty in separating them. Now, however, it was realized that there were other compounds in which the constituents were less strongly connected. One spoke of co-ordination compounds and other types; and it was becoming more difficult to differentiate between a chemical compound and a mixture. There was a gradual transition; and the fundamental work relating to coal must be carried out by a number of investigators from entirely different points of view, because at present they did not know what fundamental compounds existed. In the work at the University of Leeds for the Institution of Gas Engineers it was realized how many variables came into play in experiments on carbonization. Some of the variables were size of coal, temperature, the origin of the coal as representing differences in its constitution, the nature of the ash constituents present, the rate of heating, the thickness of the layer being heated, and a number of other factors; and by taking combinations of these factors, one could get hundreds of thousands. It was something like the possible number of forecasts of the results of twelve football matches. Prof. Cobb had pointed out that, as regarded the development of processes of carbonization, the speed of carbonization seemed to be the determining factor as to whether a new process was to be an economic proposition; and he had also referred to the carbonization of coal in powdered form. One development that would arise in the future was the transmission of heat to coal in sized form by the passage of heated gases through the retort. This was a method which required further investigation, and would probably prove useful. Then there was the possibility of substituting a badly conducting refractory material for retorts by material which was a better heat conductor—possibly some form of alloy which would also have the advantage of being non-porous. These were developments which he believed would come in the future, although there were limitations at present to their adoption. Another question concerning the efficient utilization of coal was how far present carbonizing industries and other industries utilizing coal could co-operate. For example, the gas industry, in carbonizing coal, produced coke, some of which was obtained in a more or less powdered form known as breeze and dust. This might quite usefully be employed in electricity generating stations for steam raising purposes. At the present time, a large quantity of this was used on the gas-works themselves for steam raising; but owing to developments in the recovery of waste heat for this purpose, less coke breeze was likely to be employed. Therefore more would be available for steam raising in other industries. The same sort of general statement applied to coke oven practice. There should be obtained a greater efficiency in the general utilization of the heat of coal by co-operation between industries of different types. It was in this direction that the most important steps might be taken in the immediate future. Looking further ahead, he thought they must await the results of what was called fundamental work, and not make the mistake of deciding at the moment what was fundamental and what was empirical, because they did not know.

Prof. ARNOLD LUPTON disagreed with the figures given by Dr. Lander as to the possible coal supplies of this country. Apparently these figures had been taken from the reports of the first Coal Commissions; but having worked in connection with them, Prof. Lupton said he was convinced that they had given the figures quoted by Dr. Lander, and had ignored the evidence of the geologists and the mining engineers. This evidence suggested that the amount of coal still available in this country was twice the figure mentioned by Dr. Lander. The first of the two Royal Commissions he had referred to reported in 1870, and the other some thirty years later. The reason why the figures given in these reports were so low was the large percentage knocked-off for waste working. The Commissioners of those early days had seemed to consider that the price of coal a hundred years hence would be the same as it was when they reported. They had taken the price at 5s. at the pit mouth; and, of course, at that figure the waste in working was very considerable, and it only paid to put on the market a very small proportion of a good seam of coal. All this had changed now, and the waste working was comparatively small. Moreover, in future, as the price of coal went up, the waste working would still further decrease. For these reasons, he preferred the figure of 360 thousand million tons as the available supplies of coal in this country to the very much smaller figure mentioned by Dr. Lander. From this point of view, this country was practically starting level with other countries where large supplies had become available.

Mr. C. E. STROMEYER asked Dr. Lander whether he was aware of a process adopted in Silesia, with success, for drying lignites. When dried in the ordinary way, these lignites contracted so considerably that they disintegrated. Usually, they contained 40 p.ct. of water. The process adopted for getting over this trouble was to dry the coal by soaking it in water. This might sound a little paradoxical; but the coal was placed in vessels containing water, and the vessels were heated. This had the effect of driving-off all the water and the moisture naturally present in the coal; and when the coal was removed from the vessels, it was found that it did not disintegrate. It had occurred to him that some such process might be adopted in the case of coal in which change took place below 300°, assuming that the process was carried out under pressure, so that the gases could not disappear. The use of powdered fuel would make available thin seams of coal not at present worked, provided somebody would invent a suitable apparatus for scraping-out the coal. This would have the effect of increasing the coal resources by 100 p.ct.

Sir T. HUDSON BEARE said he was able to do better and more work in bright weather than in dark weather; and as it could be assumed that this applied to the great bulk of the community, it could at once be seen how much it meant to the nation at large to get rid of smoky atmospheres. What was wanted was a smokeless fuel which would be as little trouble to ignite and burn as ordinary bituminous coal. He had been offered several fuels of this nature; but the prices were too high compared with ordinary coal.

Prof. F. C. LEA said the papers had shown engineers a little behind the veil. Engineers were usually content to take what the chemist and the gas engineer gave them, and to use it without inquiring into the processes involved. Now it was time for the engineers to do a little thinking about the preparation of the materials they used for the production of power. The fact was that for many of the processes that had been referred to in the papers to be a success, there were engineering and metallurgical problems to be solved. Engineers, also, should be thinking a little more of using powdered fuel under their boilers and furnaces. It was not employed to a very large extent at present; but if gas could be distributed throughout the community for domestic purposes and many industrial processes, it might make it more feasible to use powdered coke instead of powdered coal for steam raising purposes.

Dr. J. S. OWENS said it seemed to him the suggestion of Prof. Cobb was that no solid fuel at all should be used in houses. Personally, he did not like this idea because, although gas was a very excellent thing for cooking, one too often forgot that the problem of ventilation was wrapped-up with heating. With gas heating, a small flue was used, and little air was taken from the room, whereas with an open grate good ventilation was obtained. It occurred to him, however, that the problem of smoke prevention could be approached in another way—by trying to get a fuel which would burn smokelessly in the ordinary grate, instead of using only a fuel like gas. There was a large quantity of gas coke available; and the ordinary grate could be modified to burn it satisfactorily.

Dr. LANDER, replying to the discussion, and speaking generally of heating processes, referred to the work of Mr. Evans, of the South Metropolitan Gas Company, who a few years ago published figures showing that by fine grinding he was able to increase the density of the charge. At the present moment, work was being done in the direction of making improvements by testing varying degrees of density in the charge, and getting it more uniform. At the same time, it seemed to him, said Dr. Lander, that many of the heat transfer processes to-day were working at the point of maximum inefficiency for heat transfer. As to Prof. Lupton's criticisms, he had taken figures of a conservative character in regard to available coal supplies, and did not think anybody would have quarrelled with them on that account. The 180 thousand million tons and the 10 gallons of oil per ton he had assumed to be quite safe figures; and he had used them to demonstrate the curious position that, having all these potential oil supplies available, this country should continue to import so much oil. The suggestion made by Mr. Stromeyer as to

drying coal by soaking it in water seemed a little Gilbertian. He believed that in the future pulverized fuel would be used to a considerable extent. At the moment, however, the problem at the Research Station was not the industrial one—attention was being devoted to the domestic problem, because this was believed to be by far the more important. He was glad that Prof. Lea had brought out the metallurgical problem, because it really was a serious one, and those interested in improving methods of coal utilization were up against it. It also applied in many other branches of engineering. The question was to get heat-resisting materials much cheaper and much simpler. It was possible at present to obtain very good heat-resisting materials, such as "Cronite;" but the price was terrific, and the material was really too good for the job. If metallurgists would work on some of the simpler materials, such as cast iron with 20 p.ct. improvement in temperature resistance, many processes would be possible which were impossible to-day. The large experiment which the Gas Light and Coke Company were about to undertake at Richmond on a certain low-temperature carbonization system presented one big difficulty in the question of the heat-resisting materials. If metal which was just on the border line was used, it would be dangerous; while if a very expensive material was employed the experiment would be futile.

Prof. COBB, in his reply, said that Dr. Owens' remarks were important; but unfortunately they contained an implication which it was undesirable should go forward. He agreed with Dr. Owens as to the importance of ventilation. Living rooms had in the past been built for heating by the open fire; and one must not lose sight of the fact that the open fire burning solid fuel or gas in its proper place was also an important ventilating agent. He believed the solid fuel fire was likely to have a long life, for the reason that it provided an efficient and economical destructor. The Medical Officer for Health in Leeds had always been emphatic as to the difficulty there would be in disposing of household refuse if there were no solid fuel fires. At the same time, the coal fire was a smoke-producing fire; and he was certain Dr. Owens would agree that it was desirable that solid smokeless fuel should take the place of coal. Neither gas nor electricity could provide the advantage of the destructor afforded by the solid fuel fire, at any rate as regarded cheapness and general effectiveness; but it should be a fire burning solid smokeless fuel. As to ventilation, unfortunately there was a misapprehension on this point; and he was sorry to hear Dr. Owens say anything which would suggest that the gas-fire was not an efficient ventilator. If anything was wrong to-day with the ventilation of a gas-heated room, it could be taken for granted that something was wrong with the fixing of the fire. There was no inherent difficulty in securing perfectly efficient ventilation with gas heating. He thought it only right that this statement should be made and emphasized as much as possible.

Dr. TIDESWELL, referring to the use of fuels for household purposes, said that by a better choice of coals many of the difficulties that had been alluded to could be overcome, without resorting to any processes at all.

REMOVAL AND RECOVERY OF TAR ACIDS FROM AMMONIA STILL EFFLUENT BY MEANS OF ACTIVATED CARBON.

[CONTRIBUTED.]

Some time ago a letter appeared in the "JOURNAL" from Messrs. Robinson Bros., Ltd., of West Bromwich, suggesting that they had found a satisfactory way of treating effluent liquor. That this intimation was received by the gas industry with some sense of appreciation cannot be doubted.

A satisfactory process of treatment has been awaited for some time now. Increasing difficulty has been found in the disposal of effluent liquor; indeed, so serious did the question become that, on the initiative of the National Gas Council, the Institution of Gas Engineers appointed in June, 1926, a Committee to investigate the methods which might be adopted for minimizing the production of gas liquor effluents, or for rendering such effluents suitable for discharge to rivers and streams.

The preliminary report (which will be found in the "JOURNAL" of July 13 and 20 last) has been studied thoroughly, no doubt, by many chemists, technicians, and managers. No one can cavil with the programme of research which has been approved, and which is outlined in detail in the preliminary report. It cannot be questioned that the separation of tar from hot gas before more than a small proportion of the liquor is condensed, would result in the production of ammoniacal liquor of low oxygen absorbability. Equally, the effect of rapid cooling of the gas, and the avoidance of the circulation of ammoniacal liquor through the foul main gas producing plant, may have desirable results from the point of view of reducing the toxicity of the gas liquor.

The foregoing line of investigation must be diligently pursued, because it affects the characteristics and composition of the virgin gas liquor.

It is the belief of many (and they have much cogent evidence to support their views) that there is no justification for the production of any gas liquor other than what is now universally called virgin gas liquor.

Virgin gas liquor arises from the absorption by condensed water of the ammonia and other combining gases resulting from the carbonization of coal. Broadly speaking, the water arises from two sources: (*a*) The uncombined water of the coal substance, and (*b*) the water resulting from some of the free oxygen content of the coal substance. It is known that the virgin gas liquor need not exceed 14 to 16 gallons per ton of coal carbonized.

A third source of water arises at the gas-works where steaming of the incandescent coke in the retorts (horizontal or vertical) is undertaken; indeed, at many such works the quantity of steam used is not under effective control, and as much as 30, 40, and even 50 gallons of gas liquor are produced per ton of coal carbonized. The economic aspect of steaming needs to be seriously considered. Destruction of retorts, increase of impurities, extra costs in the distillation of gas liquor, and in some cases increased expenditure in the treatment of the effluent liquor, cost of coke, steam, and cooling water, should be set against the increased yield of gas, and a monetary balance arrived at. The foregoing consideration is one quite apart from the obvious inferiority of the quality of the coke produced following steaming.

It is believed that the advantages of steaming are not nearly so great as is frequently imagined. If it is desired to produce blue water gas, it would seem preferable to use a recognized type of plant rather than to resort to improvised apparatus. Nothing more than 16 gallons of gas liquor need be produced per ton of coal carbonized. This is clearly evidenced by those works where the secondary ammonia is absorbed in sulphuric acid.

Having reduced the volume of gas liquor substantially, the question now arises, What is the best treatment which this liquor should undergo in order to render the resulting effluent liquor suitable for discharge to the rivers or streams?

Several ways offer themselves, but the question to be decided at the outset is: Shall the gas liquor be treated, or is it preferable to confine the treatment to the effluent liquor? Basing on 16 gallons of virgin gas liquor as a total production per ton of coal carbonized, on distillation in the ordinary way it will be found that, as effluent liquor, this quantity represents 22 to 24 gallons per ton. It seems preferable, therefore, to confine the treatment to the gas liquor rather than to the effluent liquor. Have Messrs. Robinson Bros., Ltd., made any experiments with activated carbon and virgin gas liquor? If not, it would be interesting to have some data.

It is known that the Stinnes Colliery have abandoned the use of tar bases (for which they secured protection), and are now using benzole for the extraction of the phenolic bodies from gas liquor. It is understood that the process is a comparatively simple one, and that their working accounts show a profit on the process after allowing 15 p.ct. in respect of depreciation and interest on capital.

If it is logical to treat gas liquor by the benzole extraction method, it would appear equally sound to treat gas liquor (as distinct from effluent liquor) by means of activated carbon.

If the figures supplied by Messrs. Robinson Bros., Ltd., in the article appearing in the "JOURNAL" of Sept. 7 (p. 546) are not complete, then it is very difficult to form any satisfactory conclusion as to the economic value of the process. Under "The Cost of Treatment Per Gallon," is one justified in assuming that the cost of carbon covers the cost of rendering the effluent liquor slightly acid, as well as the labour and steam involved in the operation of the process? Are items in respect of repairs and maintenance, depreciation, and interest on capital also included? Even assuming that there is a slight monetary margin in favour of the process, it must not be overlooked that the effluent liquor produced from gas liquor arising from carbonization of coal in horizontal retorts as type B still possesses an oxygen absorbability of 127·27 parts per 100,000. When it is recalled that average domestic sewage only absorbs 10 parts of oxygen per 100,000, it is difficult to believe that the Rivers Boards would accept such a liquor to their streams.

The activated carbon process of Messrs. Robinson Bros., Ltd., may prove to be satisfactory for arresting the phenolic constituents. It may prove even more satisfactory for treatment of virgin gas liquor than effluent liquor. In any case, it is evident that the liquor emerging from the activated carbon purification plant will need still further treatment, to reduce the "oxygen absorbed" figure to something approaching that of average domestic sewage.

Once the financial success and relative merits of (*a*) the activated carbon, or (*b*) the benzole process, have been established, it is not improbable that ready and inexpensive means will be found for reducing the toxicity of the partially treated liquor. Such toxicity, it will be appreciated, is due largely to thiocyanates and thiosulphates. At the present juncture, one can only ask for more detailed particulars relating to the cost of treatment as applied to a unit of plant operating on a fairly large scale. The results which semi-technical scale working has revealed should be confirmed by larger scale operations.

A STUDY OF THE PHENOMENA OF ELECTROLYTIC CORROSION OF MAINS.

By A. BOLZINGER, Ancien Elève de l'Ecole Polytechnique, Chevalier de la Légion d'Honneur.

(*Continued from p.* 553)

PART IV.—STEPS TO BE TAKEN BY GAS UNDERTAKINGS AND OTHER SUBSOIL USERS—TECHNICAL INQUIRY.

Gas undertakers should have the following objectives:

1. Protection of their mains (by regular supervision).
2. In the event of corrosion occurring in spite of such protection, ability to prove that the electricity undertakings are to blame for damage. The technical inquiry will be for this purpose.

These two matters will now be dealt with.

1.—PROTECTION OF MAINS—ELECTRICAL SUPERVISION.

We have already discussed methods of directly protecting pipelines; and we have seen how little can be effected in this way. We shall not treat the matter further.

The conclusion has been reached that efforts should tend towards the suppression of the stray currents; and such is the object of the regulations that have been dealt with. Well, even assuming that suppliers of electricity adhere closely to such regulations, nevertheless we maintain that the gas engineer must not remain inactive; he must continue by appropriate methods to supervise his system with an eye on electricity. Indeed, in dealing with the French Order, we pointed out that even if earth derivations are produced by a tramway system, the undertakers are no less able to conform virtually to the regulation imposed upon them. In fact, a leakage may escape the tests carried out by a most conscientious company. Moreover, accidental breakages of contact in either the tramway or the generating plant may occur; and regulations cannot be framed to take stock of such mishaps. In short, the Order, well conceived and observed though it be, is not perfect and cannot absolutely prevent stray currents. Thus the necessity exists for the gas man to employ methodical supervision of his mains. Such supervision will be of profit to all, for it will reveal accidental faults or permanent defects in the electric grid, which the undertakers may remedy; or it may suggest modification which will render a system harmless.

We will now consider how supervision may be carried out. It will in general differ from the tests prescribed for tramway undertakings—that is to say, except in certain cases it will not consist merely in duplicating the latter's tests. Our tests, then, shall be different. They shall be of a permanent character; and their objects shall be to keep track of stray currents in the first place during normal working, and secondly when changes are occurring, usually indicating accidents in the system. We have then:

1. To draw up a chart of stray currents.
2. To select characteristic points in the system where periodical tests will be made in order to reveal changes which supervene, and faults.

Before going into further details, let us examine what instruments and processes of measurement are at our disposal.

INSTRUMENTS AND MEASUREMENTS.

According to the laws of electrolysis, the intensity of the current is the most interesting quantity to determine, since the weight of metal corroded is proportional to the quantity of current that has flowed. Unfortunately, measurements of current intensity are highly delicate (they will be studied in due course).

Differences of potential, too, are of particular importance in electrolysis; and these are far easier to measure, and may be used in the first instance in determining danger points. This method is obviously far from perfect. It is partly justified in that, according to Ohm's Law, the intensity of a current is proportional to the difference of potential; but as it is also inversely proportional to the resistance of the conductor or the electrolyte, one cannot assume that current intensity varies exactly with potential difference. However, the inexact hypothesis is accepted at any rate in the superficial work connected with electrolysis; the measure of intensity being the true method to adopt.

MEASUREMENT OF POTENTIAL DIFFERENCE.

This is effected by the voltmeter, which should be a high-resistance shunt instrument graduated in millivolts. It is unnecessary to lay stress upon the employment of this instrument for the measurement of potential difference between two metallic bodies, and upon the necessity for good contacts. However, it should be noted that small potential differences of the order of one millivolt may be due to local calorific or galvanic action, and may constitute a source of error. In measurements of potential difference between points in the ground, quite erroneous results may be obtained if, for example, iron terminals are used; errors being due to voltage differences set up by polarization at their surface.

To remedy this, Prof. Haber designed a "non-polarizable" electrode. This consists of a glass tube, the bottom of which is cemented to a porous pot containing a solution of zinc sulphate, and a rod of zinc immersed in the solution. A wire from the zinc rod is led to a terminal at the top of the tube. To connect up, the porous pot is pressed to earth at the spot where measurement is required; thus making contact between the ground and the zinc sulphate. Such an arrangement cuts out normal polarization voltages; but account must be taken of that between the zinc sulphate and the zinc rod, which is definitely known. Further, owing to the high contact resistance of this electrode, one cannot employ ordinary voltmeters, but must have recourse to special methods (such as "zero" method).

To sum up, it is of little practical use determining potential differences between points of the earth—all the more since galvanic phenomena introduce complications. Such measurements must be accepted only with reserve.

MEASUREMENT OF INTENSITY.

When the problem of measuring the intensity of the current in the main arises, the first solution which occurs to one is to cut into the main and interpose an ammeter in series with it; but obviously such a procedure can only be applied in special cases. Besides, it has the defect of introducing the resistance of the ammeter in the circuit in place of a piece of pipe, and so seriously modifying the conditions. The disadvantage may be remedied by the addition of suitable shunts.

The second method consists of measuring the pressure drop on a length of main of which one knows the electric resistance, any applying Ohm's Law. This demands the most exact measurements of potential difference—of the order of one hundredth of a millivolt, and precise knowledge of the electrical resistance of the main. This quantity is a very doubtful one; and so the method is obviously defective. The following table indicates the order of magnitude of the quantity in question:

Cast-Iron Pipes.

Diameter.	Weight in Lbs. per Ft. (1 Lb. = 45·3 Gr. 1 Ft. = 304 Mm.)	Resistance in Ohms per Ft.
3 in. = 75 mm. (approx). .	11	0·000131
4 in. = 100 mm. ,, . .	18	0·000130
6 in. = 150 mm. ,, . .	31	0·0000465
8 in. = 200 mm. ,, . .	42	0·0000343
10 in. = 250 mm. ,, . .	55	0·0000262
12 in. = 300 mm. ,, . .	70	0·0000206
16 in. = 400 mm. ,, . .	109	0·0000132
18 in. = 450 mm. ,, . .	130	0·0000111
20 in. = 500 mm. ,, . .	151	0·00000955
24 in. = 600 mm. ,, . .	205	0·00000702
30 in. = 750 mm. ,, . .	294	0·00000490
36 in. = 900 mm. ,, . .	408	0·00000353

Wrought-Iron Pipes

Diameter in Inches.	Resistance in Ohms per Ft.
0·84	0·000215
1·7	0·000106
2·7	0·000067
3·6	0·0000502
7·5	0·0000341
10·6	0·0000171
18·8	0·00000963
28	0·00000647
40	0·00000452
49	0·00000369

Heavy Iron Pipes.

Diameter in Inches.	Resistance in Ohms per Ft.
1·1	0·000164
2·2	0·000082
3·6	0·0000502
5	0·0000362
10	0·0000181
15	0·0000121
29	0·00000623
43	0·00000421
54	0 ·00000335
65	0·00000278

Diameter in Inches.	Resistance of a Main 1 Mile Long Laid on Insulated Supports (Run and Caulked Joints)—Ohms.		
	Max.	Min.	Mean.
6	15·29	3·72	4·50
8	6·87	5·52	6·19
12	4·80	0·62	2·71
20	1·33	1·05	1·19
30	1·96	0·56	1·20

There exists, however, a simple method of measuring the intensity of current flowing in a pipe—the "zero method." The apparatus is shown in fig. 4. The resistance R is set so that

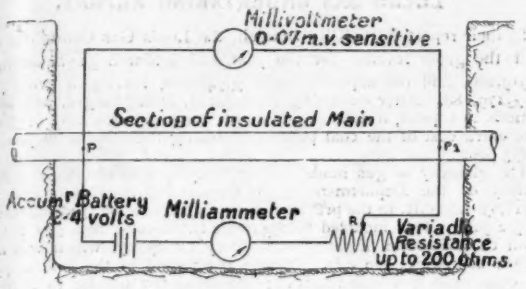


Fig. 4.

the millivoltmeter registers zero. The current flowing through the ammeter is then equal to that in the main. This method is one of some delicacy when the current to be measured is a variable quantiy. It is by no means easy to follow the current variations with the resistance R. This is not absolutely correct; but in the case of a 500-volt tramway system, assuming a low resistance between contact points, one can take it as correct. (The test pressure and the resistance of the main between P and P_2 are so small compared with the E.M.F. of the main current and the resistance of the track that one can neglect them; and consequently the results of these tests exactly represent the large-scale conditions.)

Finally, for measuring the current flowing through the ground, Prof. Haber has designed an earth ammeter. In this instrument soil is enclosed between two copper plates carried on a wooden framework; and this layer of earth is buried in the ground at right angles to the direction of flow of the current to be measured (see fig. 5). The ammeter shows the quantity of current intercepted.

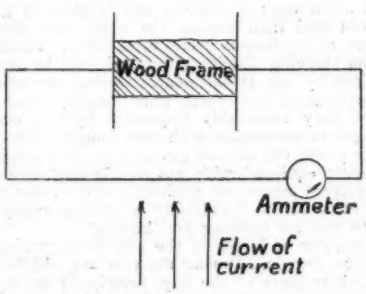


Fig. 5.

Alternating Current.

For the measurement of alternating currents, one must make use of thermo voltmeters and ammeters. As alternating current is of far less importance as regards electrolysis, it is possible that the engineer will shrink from the outlay necessary for such an apparatus; and recourse may be had to telephonic detectors. Thus a qualitative reading is obtained in the absence of a definite measurement.

(To be concluded.)

Holder Guide to Flyers.—After completing the painting of a holder at Des Moines, the U. G. I. Contracting Company, at the request of the Des Moines management, painted on the crown an arrow as a guide for aeroplanes passing over the city. The arrow is 130 ft. long; and the head is 35 ft. wide. The body is 15 ft. wide. Two coats of flat white paint and one coat of flat white enamel were used; and the name "Des Moines" appears in black.

Wales and Monmouthshire District Institution of Gas Engineers and Managers.—A meeting of the Institution will be held in the Council Chamber, Porthcawl, on Thursday, Sept. 22, at 11 o'clock, when the chair will be taken by the President, Mr. A. T. Kyle. At this meeting the President-Elect, Mr. D. W. Davies, will be introduced, and Mr. H. D. Madden (President of the Institution of Gas Engineers) will present Certificates and prizes to members of the South Wales and Monmouthshire Junior Gas Association. Two papers will be read and discussed—one by Mr. W. Clark Jackson, of Neath, on "Service to Consumers" (see "JOURNAL" for May 25), and the other by Mr. T. Anthony Canning, of Woking, on "Present-Day Problems." After luncheon at the Coney Beach Dance Restaurant, at the invitation of the Chairman and members of the Porthcawl Gas Committee, members of the Institution will make an official visit to the Gas Exhibition which is being held in the Hall adjacent to the restaurant.

Gas Growing in Favour for Hospitals.

The assertion is made by Mr. Alexander Forward, Managing Director of the American Gas Association, that gas, because of its cleanliness, is finding increasing use in hospitals and institutions. "Medical opinion is alive to the fact that the public is starved for sunshine," says Mr. Forward. "The value of the ultra-violet rays is no longer disputed; and the efforts being made to prohibit and eliminate the smoke nuisance are certainly steps in the right direction. It is only fitting that hospitals should lead public opinion by doing their part in abolishing smoke. The clean heat from gas is not only beneficial because of the high percentage of radiant heat contained in it, but is also of assistance in hospitals, where dirt, dust, and smoke retard recovery. In the modern hospital are found many uses for gas. Gas supplies the hot water, both for sterilizing and for sanitary purposes. In addition, it is used for room heating, incineration, pasteurization, and refrigeration. Gas proves specially valuable in the laboratory."

Reducing Clinker Trouble with Fine Fuel.

In suggesting a "wrinkle," our contemporary the "American Gas Journal" remarks that frequently fine coke or coal is available as boiler fuel at a very low cost; but sometimes advantage cannot be taken of this fuel, because of the greater difficulty in connection with clinkering. This difficulty is often minimized by injecting considerable quantities of steam under the grate bars; but this may represent such a value in steam as somewhat to off-set the low cost of the fuel. One engineer whose boiler installation permitted burning of fine fuel only under heavy forced draught combined the problem of generating this draught and supplying the steam under the grates in an ingenious fashion. He used a steam-driven fan as a blower, and allowed the exhaust from the engine to discharge at the intake of the fan. Thus the fan not only provided forced draught, but also carried the exhaust steam under the grates. The advantages of soft clinker, exhaust steam disposal, and convenient operation with a single unit were thus obtained.

British Standard Engineering Drawing Office Practice.—Recommendations for British standard drawing office practice, dealing with a standard procedure for submitting drawings, tracings, and blue prints, to be adopted by manufacturers and contractors, have just been published by the British Engineering Standards Association. Considerable care has been expended by the Committee in the preparation of this publication, so that no hardship should fall on any firms, should the recommendations contained in the report not be in strict accordance with their usual practice. To cover this contingency, a "Note" has been included which suggests that purchasers should not enforce the manufacturer or contractor to make new drawings to comply with the "B.E.S.A." recommendations if the contractor already has old drawings and tracings in stock which would serve the purpose. The scope of the report covers the over-all sizes of tracing cloth and paper, position of drawing number, date and name, indication of scale, method of projection, types of lines and writing, dimension figures, relative importance of dimensions, indication of material on drawings, screw-threads, flats and squares, and tapers, together with explanatory diagrams. It will quickly be recognized that any special convention relating to one particular industry had to be avoided. For this reason many useful abbreviations and conventions have had to be dispensed with. Copies of the report may be obtained from the British Engineering Standards Association, 28, Victoria Street, S.W. 1, price 2s. 2d.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

The Price of Cast-Iron Pipes.

SIR,—Owing to absence, I have only just had placed before me your issue of the "JOURNAL" for Aug. 17.

I have read with interest Mr. E. J. Fox's letter published in that issue. I do not think it can be said that the gas industry generally is under the impression that the prices of British made cast-iron pipes are controlled or in any way regulated—at any rate, I have not been able to obtain any corroboration of this. On the other hand, it has long been my contention that the British gas industry has not fully appreciated the advantage of the existence of foreign competition.

If the gas industry of this country does not buy foreign pipes, foreign competition will be eventually eliminated; and this might conceivably result in the re-formation of the Cast-Iron Pipe Association, and consequently higher prices.

In other words, those gas companies who have in the past purchased Continental cast-iron pipes have rendered, and are rendering, those who have not yet done so a greater service than they themselves possibly realize.

A. S. ARUP.

10, *Philpot Lane, E.C.* 3,
Sept. 12, 1927.

MISCELLANEOUS NEWS.

NEW HEAD FOR THE MANCHESTER CORPORATION GAS DEPARTMENT.

General Manager and Chief Engineer.

The minutes of the General Purposes Committee submitted to last Wednesday's meeting of the Manchester City Council contained a recommendation for the Council to advertise for a General Manager for the Gas Department.

Mr. Toole asked whether the Chairman of the Gas Committee was prepared to make such an office really effective by combining with the position of General Manager that of Chief Engineer. There would then, he remarked, be no question of his superiority over everybody else in the department.

Alderman COOK agreed to this; and the recommendation was adopted.

THE BRADFORD ROAD GAS-WORKS EXPLOSION.

On the motion of Mr. JAMES, seconded by Mrs. DORA TAYLOR, the Council placed on record its deep appreciation of the courageous conduct of the men who remained on duty under the trying circumstances of the recent explosion at the Bradford Road Gas-Works, and also of the teachers in adjacent schools, who acted with foresight and promptitude in preventing panic among the children in those schools.

The minutes of the Committee contained a resolution to instruct a Manchester firm to undertake the necessary repairs to No. 1 and No. 2 gasholders at the Bradford Road station, and to carry them out under the direction of the Consulting Engineer.

Mr. J. WILLIAMS and Mr. COX opposed the calling in of the Consulting Engineer on the ground of unnecessary expense. Mr. Williams contended that the two Resident Engineers were quite competent to supervise the work.

Alderman GOLDSCHMIDT asked whether it was the intention of the Committee to rebuild both of the holders. He was informed that, while one could be put into order in time for meeting the winter demand, the other could not, and that in the meantime a supply would become available from the new Partington Works.

Alderman COOK said the policy of the Committee was to allow no important work to be done by contractors without supervision. The holder most badly damaged was No. 4; and the Committee had no intention of putting this into commission at present. No. 1 was to be repaired; and it was necessary to make an inspection of No. 2 in order to ensure against further trouble.

Mr. BINNS inquired whether the Gas Committee were able to give an explanation of what caused the explosion, and suggested the desirability of completing the investigation before starting repairing operations which might destroy the chances of finding the cause.

The minutes of the Committee were eventually confirmed.

SALFORD GAS COMMITTEE'S REPORT.

The report of the Gas Committee to the Council of the City of Salford (which is signed by the Chairman, Alderman F. S. Phillips), for the year ended March 31 last, records a further substantial increase in the sales of gas, amounting to 5·7 p.ct. The coal carbonized during the past year was 146,991 tons, as compared with 138,248 tons in the previous year. The quantity of gas made was 2,089,474,000 c.ft., as compared with 1,978,623,000 c.ft. This again creates a record, being 110,851,000 c.ft. greater than the make of gas for the previous year.

The total number of gas cookers (ordinary and prepayment) on hire at March 31 was 27,089, an increase of 2528 during the year; and the total number of gas fires on hire at the same time was 8326, an increase of 1031. These figures are most encouraging, and clearly show that householders are still further appreciating the advantages of gas for cooking and heating, as compared with the use of solid fuel.

The receipts from the sale of gas and rental of stoves show an increase of £75,337, due to the substantial growth in the demand for gas and to the higher prices which came into operation on Oct. 1, 1926, and Jan. 1, 1927. These advances in price were, unfortunately, rendered necessary by the enormous increase in the price of coal due to the national stoppage. The receipts from the sales of coke show an increase of £43,403, and there is also an increase in the receipts from the sales of tar of £17,246; but for sulphate of ammonia there is a decrease of £1260.

These figures are very satisfactory; and this large increase in the total value of residual products has enabled the Committee to recommend the Council to reduce the price of gas at an earlier date than was anticipated when the last increase in price was sanctioned by the Council in December. The Committee, therefore, on June 24, decided to recommend the Council to reduce the price of gas, and passed resolutions that from and after the reading of the meters for the quarter ending Sept. 30, 1927, the price of gas to all consumers by ordinary meters within the area of supply be reduced by 6d. per 1000 c.ft., and that the price of gas to consumers by prepayment meter be reduced by increasing the quantity of gas supplied for 1d. from 16·70 to 18·29 c.ft. These recommendations were approved by the Council on June 29.

Cheap Gas at Aberdeen.—At a meeting of the Gas Committee of the Aberdeen Town Council, it was reported that the estimated revenue for 1927-28 amounted to £255,394 and the expenditure to £256,593, leaving a deficit of £1199. The revenue is estimated on a charge of 2s. 3d. per 1000 c.ft. for gas, as compared with the present price of 2s. 6d. Rebates of 5 to 10 p.ct. (according to quantity) are allowed to large consumers.

LEEDS GAS UNDERTAKING REPORT.

In their report to the City Council, the Leeds Gas Committee state that the gross revenue for the year ended March 31 amounted to £919,286, and the expenditure to £740,098, leaving a gross profit of £179,188. After deducting income-tax, loan charges, and contributions to capital, a deficit remains on the year's working of £2052. The extra cost of the coal purchased during the miners' dispute was £133,900.

The quantity of gas made during the year was the highest in the history of the Department—3,495,589,000 c.ft., as compared with 3,321,830,000 c.ft. in the previous year, an increase of 173,759,000 c.ft., or 5·2 p.ct. This included 86,254,000 c.ft. of coke oven gas received from the Middleton Estate and Colliery Company, which was a decrease of 306,932,000 c.ft. During the period of the coal stoppage no coke oven gas was received; the deficiency having to be made up by the carburetted water gas plant. The yield of gas per ton was 14,720 c.ft., as compared with 14,240 c.ft. during the preceding year, an increase of 480 c.ft. per ton. The quantity of carburetted water gas produced was 691 million c.ft.

The sale of gas was the highest on record, due in a great measure to the increased demand during the coal stoppage. The total quantity sold was 3,302,868,000 c.ft., compared with 3,136,528,000 c.ft. last year, an increase of 166,340,000 c.ft., or 5·3 p.ct. The amount sold per ton of coal carbonized was 13,908 c.ft., compared with 13,445 c.ft., an increase of 463 c.ft., or 3·44 p.ct. The gas unaccounted for was 6·2 p.ct., as compared with 6·4 p.ct.

The number of ordinary meters in use on March 31 was 63,370, as compared with 64,633 for the preceding year, a decrease of 1263. The total number of meters in use was 129,468. The total length of mains in the area of supply is 1098 miles, which is the greatest mileage in the kingdom, except London, Glasgow, and Birmingham.

Owing to the enormous increase in the cost of coal, the Committee very reluctantly advanced the price of gas 6d. per 1000 c.ft. from the meter reading in September, and in order to recover a portion of the increased expenditure had to again increase the price 10d. per 1000 c.ft. from December. At the end of the March quarter half the above increases—viz., 8d. per 1000 c.ft.—was taken off the price; and it is hoped in the near future to revert to the pre-stoppage scale of charges.

The great advantages of cooking and heating by gas were never better demonstrated than during the acute coal shortage; and a great number of appliances were fitted then. Much interest was created at the Building Trades Exhibition held in the Drill Hall by a stand erected by the Department. During the short run of the exhibition upwards of 250 orders were actually taken; while many builders were very favourably impressed by the convenience and economy of gas in connection with new houses. The Improvements Committee now see the advantages of gas, and practically all new houses are being equipped with gas as the only means of cooking; while on a private estate, as a direct result of the exhibition, 100 houses were fitted with a "Califont" geyser to supply all hot water, in addition to gas for cooking and heating.

The total number of lamps in the city is 17,775, of which 17,006 are gas and 769 electric. During the year 222 additional lamps were erected in various parts of the city, principally on housing estates; and a further 4000 controllers were fitted to existing lamps.

GOOD YEAR AT SHREWSBURY.

Presiding at the meeting of the Shrewsbury Gas Light Company, when a final dividend making 6 p.ct. for the year (less tax) was declared, Mr. J. B. Lloyd said that, in spite of the difficulties connected with the coal stoppage, there had been no interruption of the supply of gas to the consumers—in fact, an increased demand was met. The working results showed an improvement in the yield of gas per ton and in the percentage of unaccounted-for gas. Sales of gas showed an increase of 8 p.ct. in volume as compared with the previous year, and of over 40 p.ct. as compared with ten years ago.

The prospects for the new financial year, he said, appeared promising. There was evidence of increasing appreciation of the advantages of gas as a fuel, in the lively demand for gas apparatus of various kinds. The price of gas had been reduced, and a wider scale of discounts had been put into operation, for the two-fold purpose of encouraging the more extensive use of gas and the earlier payment of accounts.

Replying to a point raised with regard to the possibility of paying a little higher dividend, Mr. C. M. D. Belton (the Engineer, Secretary, and Manager) said the Company would be within their legal rights in increasing the dividend; but the Board always had in view the fact that they were undertaking a public service. The first thing they had to consider was the proper relation between their responsibilities to the shareholders and the consumers, and a proper division of the funds available for that purpose. Nothing was overlooked in this matter; and the interests both of the shareholders and the consumers were actively before the Directors on every occasion when these matters came up for consideration.

Reduction at Newport.—The price of gas at Newport has been reduced to 4s. 5d. per 1000 c.ft. The new rate for prepayment meters is 4s. 9d. per 1000 c.ft.

Dividends at Rugby.—The Rugby Gas Company have declared an interim dividend of 15½ p.ct. per annum on the 10 p.ct. standard shares, and 12½ p.ct. per annum on the 7 p.ct. standard shares, less tax.

ELEMENTARY SCHOOL TEACHERS AT THE SMETHWICK CORPORATION GAS-WORKS.

PHOTOGRAPH TAKEN DURING THE VISIT.

On Thursday, Sept. 1, a party of 170 elementary school teachers visited the works of the Smethwick Gas Department. Alderman G. F. Betts, J.P. (Chairman of the Education Committee), and Mr. S. Childs, M.A. (Director of Education for the Borough), were among the party, which was met by Alderman C. W. Pinkney, J.P. (Chairman of the Gas Committee), and Mr. E. Hardiker, F.C.S. (Engineer and Manager.) The visitors were entertained at tea; and after a photograph had been taken, they were conducted round the works in eight groups.

The teachers were very interested in all they saw, and, judging by the type and number of questions asked, were greatly surprised at the magnitude of the operations carried out. The spiral-guided holder of 3½ million c.ft. capacity, which is now under construction, specially attracted the majority of the visitors.

In connection with the education of gas fitters, the Chairman of the Gas Committee a week or two ago presented to four fitters' youths money awards and certificates for results obtained in examinations. The Smethwick Gas Department have become associated with the Birmingham Gas Department for technical classes for fitters' youths; and the result of the last year's work has been gratifying.

GLASGOW'S GAS PRICE.

An Official Reply to Criticisms.

In view of the fact that a number of uninformed criticisms of the high price of gas in Glasgow have appeared recently in the public Press of the city, a Special Sub-Committee of the Gas Committee of the Corporation have prepared a statement explanatory of the causes which have entailed this high price; and the statement has been approved by the Gas Committee. The main portions of the statement are as follows:

During the five years previous to the war, the standing charges (by which are meant interest and sinking fund, rents, rates and taxes, depreciation, &c.) of the Gas Department averaged 8·39d. per 1000 c.ft., and coal averaged the low price of 10s. per ton delivered in the works. These costs, coupled with low wages, enabled the Department to sell gas at 1s. 11d. per 1000 c.ft., and make ends meet.

Heavy Capital Charges.

All engineering reconstruction or new work in connection with the gas-works had been seriously delayed during the war period, with the result that the Committee were forced, early in 1919, to proceed immediately with large extensions and reconstructions then already overdue. All this work held-up during the war period had to be paid for when wages and the cost of materials were at the peak. Further, there were heavy capital charges involved in the reconstruction of the chemical works in the years 1920 to 1923, and still heavier outlays in the distribution section for mains, services, and appliances in connection with new housing schemes. These three sections involved an increased capital outlay of over £3,000,000 in eight years. But the economies effected by the introduction of new plant were fully justified, as the price of gas was reduced in four successive years—viz., 4s. 7d., 4s., 3s. 8d., and 3s. 2d. per 1000 c.ft. for ordinary consumers (equal to a total saving for consumers of £629,000 per annum).

Three Coal Stoppages.

During the past eight years the Department have had to encounter all the troubles and difficulties connected with no less than three coal stoppages. During the last and most prolonged of these the revenue from the supply of gas did not nearly meet the expenditure of making it.

The Gas Committee have been criticized for not rationing the supply of gas during this coal stoppage when they knew that the price charged could not meet the abnormal expenditure, and that an accumulated deficit would result. A scheme of rationing was actually published; but no sooner did the notice appear in the Press than the Department, the Lord Provost, and the Chairman of the Fuel Committee were inundated with appeals for a steady supply of gas, and the Emergency and Fuel Committees decided, after careful consideration, that the gas supply must be fully maintained, in spite of the very serious financial burden which would be imposed on the Gas Department. The Committees were compelled to this decision in order that the industries of the city using gas for power and other purposes might be carried on, and thus avoid the necessity of throwing a further 55,000 persons into unemployment.

During the first five months of the coal stoppage, gas users were consuming gas at the low rate of 3s. 2d. per 1000 c.ft., and at 3s. 8d. in October and November, when coal for household purposes was either very costly or unobtainable. Moreover, the new maximum charge of 5s. 2d. only became payable after the termination of the coal trouble; and no consumer will be asked to pay this rate for a longer period than nine months.

Accumulated Deficit.

The estimated expenditure and revenue for the financial year ending May 31, 1928, shows that the Department could charge an ordinary average rate of 3s. 2d. per 1000 c.ft. and come out with a level balance-sheet, if there were no accumulated deficit from previous years.

The amount of the deficit due to the coal stoppage is £946,000; and a contribution towards this deficit must be included in the price of gas until the deficit has been wiped off. In the estimated expenditure and revenue accounts for the financial year ending May 31, 1928, the cost of manufacturing and distributing gas totals 1s. 8d. per 1000 c.ft. This is a very satisfactory figure, and compares favourably with any of the larger municipalities; but to this falls to be added 1s. 6d. per 1000 c.ft. for standing charges, represented by sinking fund and interest on capital borrowings, which, as has already been explained, were increased by over £3,000,000 during the last eight years. This high amount for standing charges is mainly responsible for the price of gas being higher than that of many other gas undertakings in Scotland; but the capital expenditure already referred to was absolutely necessary to bring the works up to modern requirements. These figures of 1s. 8d. and 1s. 6d., *plus* 1s. 1d. to meet the deficit due to the coal stoppage, bring out the price of 4s. 3d. proposed to be charged during the next reading of meters.

This Year's Outlook.

In reducing the present price of gas from 5s. 2d. to 4s. 3d., it is assumed that the consumption will be equal to that of last year; and, if so, it is estimated that a very substantial surplus will be available to set against the accumulated deficit. When this deficit is completely wiped off, the price of gas can be reduced to an average rate of not more than 3s. 2d. per 1000 c.ft., or lower if costs permit.

The increased revenue from the sale of coke last year totals £156,000. This figure is out of all proportion relatively to the increased cost of coal, and would have been much higher had the Department been allowed to sell in the open market. The Fuel Committee were, however, very reluctant to release coke, having in mind the position of many of the smallest householders, who were ultimately supplied by rationing ticket; and it should not be lost sight of that the Department were maintaining supplies of gas and coke, not only to private consumers, but to industrial concerns, at very moderate rates right through the long period of the coal stoppage.

Coal Imports.

As illustrating the difficulties under which the Department operated, it might be explained that during the latter part of November the Emergency Committee, knowing that the gas supply was taking the

place of coal in practically every home and business premises, and must be maintained, sanctioned the Department covering requirements until the end of December. By this time cargoes were most difficult to secure; and the freight rate was increasing daily. Orders for cargoes on the American ports were taking a three weeks' turn, and at the rate of carbonizing in Glasgow—nearly 3000 tons per day—the Department had no alternative but to keep requirements covered one month ahead.

During the course of the dispute, while the price of coal was increased from 20s. 6d. to 28s., on the American side the freight rate was increased from 14s. to 42s. per ton. When the coal dispute terminated at the end of November, the Department held a stock of 33,000 tons, equal to 11 days' supply, instead of the normal stock of 100,000 tons. At this date the Department were committed to take delivery of 105,000 tons of American coal at 70s. per ton, when home coals were being offered at 85s. per ton. This rate for home coals was reduced rapidly, mainly because the largest buyers of coal were likewise committed.

High Prices for Coal.

It cannot be claimed that the collieries in this area had reached a position to supply adequately the Department's requirements during the month of December, as a number of the larger collieries did not attain normal production until the middle of January. The Department purchased 661,042 tons of coal at an average price of 57s. 7d. per ton during 1926-27, and have contracted for 761,000 tons at 17s. 1d. per ton for the year 1927-28.

It will thus be obvious that the present high price of gas is due to causes over which the Corporation and the Manager had no control, but that the outlook for a further reduction in the near future is very promising.

"THE TRUTH."

Writing under this heading in "Forward" for Sept. 10, Councillor John S. Clarke replies to the critics of the Glasgow gas prices. He mentions at the start that the entire wage bill of all grades in the Gas Department over the grade of clerk amounts to the sum of £14,800 per annum—less than the amount realized by raising the price of gas ½d. per 1000 c.ft. There are, he states, 240 gas undertakings in Scotland, 36 of which sell gas at a price between 3s. and 4s. 3d. per 1000 c.ft. Glasgow is one of these 36. Helensburgh, Kirkintilloch, Greenock, and Aberdeen are the four very low priced towns; but 200 are higher than Glasgow. In the latter town the average consumption of gas per household is 29,000 c.ft. In Helensburgh it is 45,000 c.ft. per year.

Mr. Clarke observes that, until the calorific value of gas is known, comparisons of price based on volume are worthless. For instance, the C.V. in Greenock is 410. In Helensburgh it is the same, and in Kirkintillock it averages 450 B.Th.U. per c.ft. On the other hand, in Glasgow it is 470 B.Th.U.; and consequently 1000 c.ft. of Glasgow gas will do more work than 1000 c.ft. of the gas supplied by these other towns.

Cost of Production and Distribution.

Glasgow gas, continues Mr. Clarke, is produced at a net cost of 3s. 2d. per 1000 c.ft. This figure is made up by adding production and distribution costs = 1s. 8d., to standing charges = 1s. 6d. The latter figure is two-thirds higher than the average of the four low priced undertakings, Aberdeen, Helensburgh, Kirkintilloch, and Greenock, which amounts to 6d. If Glasgow's standing charges could be reduced to the same figure as the average of these four towns, gas could be sold for 2s. 2d. per 1000 c.ft. That the standing charges are high is no fault whatever of the present management. In pre-war times these charges amounted to 9½d., and coal was 10s. per ton. Rates and taxes as well as wages were very low. The result was that Glasgow sold its gas at 1s. 11d. per 1000 c.ft. Since those happy days coal prices have increased by over 52 p.ct., wages by 62 p.ct., standing charges by 89½ p.ct., and stores, materials, &c., by 14 p.ct. In short, the net cost of gas has increased by more than 65 p.ct.

In eight years the Corporation Gas Department has increased its capital expenditure by over £3,000,000, due to reconstruction work. The new plant installed effected sufficient economies to permit the price of gas to be reduced during four years from 4s. 7d. to 3s. 2d. per 1000 c.ft., thus saving to the ordinary consumers the sum of £629,000 per annum.

High Price due to Coal Strike.

The reason why Glasgow has been charging 5s. 2d. for a number of months is because of the coal dispute. When the trouble began in May last year the Department had on hand just over 120,000 tons of coal. An Emergency Committee was formed to superintend the purchase of available supplies of coal. With only twelve weeks' supply on hand, and believing the crisis would be over in August, the Committee sanctioned the purchase of 50,000 tons of foreign coal to be mixed with the home stock. From this time onward foreign coal was purchased after consultation with the Emergency Committee. In June a rationing scheme was approved, and its details were published. This would have reduced the supply by 50 p.ct., and would, therefore, have reduced any deficit by 50 p.ct. (more, as a matter of fact). Immediately after it became known that this step was contemplated, the various Committees and the Lord Provost were approached by deputations, and literally inundated with appeals to abandon the idea of rationing the supply. To reduce the supply meant braking certain industries and throwing another 55,000 men into unemployment. Rationing, therefore, was abandoned; but by this time gas had taken the place of fuel in almost every home, and the problems of the Gas Department were intensified by the enormously increased demand. By November the works were carbonizing no less than 2500 tons of coal per day at an enormous cost to the Department. The freight rate per ton increased from 14s. to 42s.; and as each cargo consisted of only 6000 tons, it took three cargoes per week to keep the supply of gas equal to the heavy demand. Thirty p.ct. more plant was put into commission to allow for the inferiority of the imported coal, and this meant additional outlay *plus* wages for 450 extra workmen. Taking the year with its seven months of turmoil, the foreign coal amounted to 65 p.ct. of the total, and the average cost per ton was 57s. 7d.

Consequences of the Strike.

The consequences had to be faced—a deficit of £946,336. The citizens are paying for that deficit now, because not a penny piece was added to their gas bill during the first five months of the coal stoppage. When the price was increased, it was only raised by 6d. (from October to November). Since December, for a period of nine months only, it has been 5s. 2d. per 1000 c.ft. To place the matter in a different way, the Gas Department produced gas for the financial year 1926 at an average cost of 5s. 11d. per 1000 c.ft., and sold it to the consumers at an average price of 3s. 10d., thereby losing 2s. 1d. on every 1000 c.ft.

A Comparison.

Did this exorbitant coal price hit the other undertakings as well as Glasgow? It did, but not to the same extent. During November Helensburgh carbonized 896 tons of coal—nearly 30 tons a day. Kirkintilloch only required 27 tons a day. The entire month's supply of coal of both towns added together was consumed by Glasgow every fifteen hours.

TRIBUTE TO LOYAL SERVICE AT BRISTOL.

Award of Certificates to Long Service Pensioners.

The Bristol Gas Company have in operation a non-contributory pension scheme whereby at present 44 of their former workmen, laid aside by age or ill-health, are benefiting. The Directors decided to issue to these pensioners certificates of long service, and invited them to tea in the board room at the offices of the Company. Sir George E. Davies (Chairman of Directors) presided. There were present Lady Davies, Mr. G. H. Boucher (Director), Mr. S. C. Halliwell (Secretary), Mr. R. Robertson (Engineer), and other officials of the Company. It is interesting that six of the pensioners who attended have put in over 314 years' service for the Company.

Loyal Service.

Sir George E. Davies expressed the great pleasure it gave the Directors to meet the old workers in that most interesting way, and their appreciation of the long and loyal service which had been rendered to the Company. It had always been in the minds of the Directors that the employees were entitled to all the consideration they could give them in their old age, when their life's work was more or less done. In fulfilling that, they had for some years had a pension scheme, which was non-contributory. It was a graduated scheme of pensions for men of 20 years' and upwards continuous service, who had been incapacitated by age, illness, or accident. At the present time 44 workmen were receiving pensions. Nine of them had each been in the service of the Company for from 50 to 55 years; nine 40 to 45; nine 35 to 40; and twelve for shorter periods. He thought that this provision had done something to build up the excellent relations which undoubtedly existed between the workers and those responsible for the management. The Directors had lately thought that it would be gratifying to the pensioners to have some permanent record certifying the good work they had done, and expressing the Directors' appreciation of it. They had, therefore, prepared framed certificates in colours bearing views of the head offices and the Company's works, and stating that they were conferred as a mark of appreciation of long and faithful service. He hoped that the pensioners would value these certificates, and that they would remind them of their pleasant business relations with the Company with which they had been so long associated.

Lady Davies then distributed the certificates.

Mr. F. W. Townsend, on behalf of the retired foremen, proposed a hearty vote of thanks to the Directors and Lady Davies. He remarked that they were very grateful to the Directors for the kind help they were giving to men who had retired owing to age or infirmity.

GAS REGULATION ACT APPLICATIONS.

SPECIAL ORDERS.

Dursley Gas Light and Coke Company, Ltd.

To extend the limits of supply so as to include the parish of Stinchcombe; to empower the Company to utilize scheduled gas lands; and for other purposes.

Newcastle-upon-Tyne and Gateshead Gas Company.

To provide for the transfer to the Company of the undertaking of the Tynemouth Gas Company, and for the raising of capital, &c.; to make provision as to the price to be charged by the Newcastle Company for gas supplied in the area now served by the Tynemouth Company, and to authorize the charging of differential prices; and to enable the Newcastle Company to use certain lands for gas-works purposes.

DECLARATION OF CALORIFIC VALUE.

Knaresborough Urban District Council.—500 B.Th.U., in substitution for 540 B.Th.U. (Jan. 1, 1928).

By appointment.

ILLUSTRATION shows a new CARRON GAS MANTEL REGISTER specially adapted for modern Housing requirements. It is fitted with seven radiants, silent burner with brass inlet tap fitted with gas and air adjuster, suitable for right or left hand connection; brass knob to fret; gas fire is separate from mantel, but screwed to it; all parts are accessible from the front for cleaning or renewal without removing mantel or fire.

¶ *No. 6M Gas Fire Catalogue Post Free.*

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Works: CARRON, STIRLINGSHIRE.
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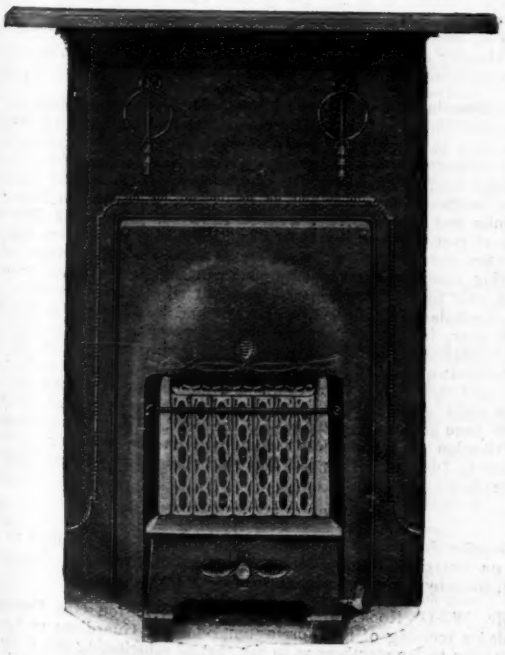

No. 1296G Gas Mantel Register Grate.

COAL TRADE REPORTS.

From Our Own Correspondents.

NORTH-EAST COAST.

The market has had a poor week, and some sections have shown marked weakness. Northumberland steams have been specially affected, and shortage of trade has led to general offering of best large sorts at 14s. for prompt and 14s. 3d. for forward delivery, against recent quotations of 14s. 6d. The Durham market has been fairly well maintained, though the tone has been weak, and orders generally scarce. Gas coals are perhaps in best demand, and have hopes of steadier trade from seasonal export requirements. Nearly all collieries are leading a hand-to-mouth existence, however, and only the very best qualities are able to see more than a week or so ahead. Foreign competition is always severe, and, whatever the reason, it seems quite impossible to fix up contracts, which are the backbone of steady and successful colliery working.

Wear Special gas makes are nominally 16s. 3d. f.o.b., and best qualities quote 16s. Seconds are 14s. to 14s. 6d.; but these prices can be discounted for some brands. Coking coals remain very slack, and quite good makes can be bought as low as 13s. 6d. Best Durham bunkers are 14s. 3d. to 15s. 3d. according to place of shipment. Seconds are weak at 13s. 6d. to 14s. Gas coke continues steady at 20s. 3d. to 20s. 6d. f.o.b. for shipment.

YORKSHIRE AND LANCASHIRE.

Gas coal in Yorkshire and Lancashire is moving more steadily, and tonnages are increasing, as is to be expected at this time of the year.

Cheap fuel is still obtainable for ordinary industrial purposes, although many South Yorkshire collieries worked very little last week, owing to the Doncaster races.

The lack of export orders continues to provide an opportunity for securing cheap steam-raising fuel for home consumption, although so far manufacturers have not taken much advantage by placing into stock fuel offered for sale at figures below the cost of production.

The colder weather, coupled with the possibility of an advance in price in the near future, has resulted in a rather better demand for house coal, although the tonnage involved is not sufficient to make any increase in the working hours of pits.

The following are the Humber bunker and export prices (f.o.b. usual shipping ports): South Yorkshire—Hards, Association, 17s. 6d. to 18s.; screened gas coal, 16s. 6d.; washed trebles, 16s. 9d. to 17s. 6d.; washed doubles, 16s.; washed singles, 15s. 6d.; washed smalls, 11s. 7½d.; rough slack, 10s.; smithy peas, 17s. to 18s. per ton. West Yorkshire—Hartley's (f.o.b. Goole), 15s. to 15s. 6d.; screened gas coal, 15s. to 15s. 9d.; washed trebles, 16s. to 16s. 6d.; washed doubles, 15s. to 15s. 6d.; washed singles, 15s. to 15s. 6d.; washed smalls, 11s. to 11s. 3d.; unwashed trebles, 15s. 3d. to 16s.; unwashed doubles, 12s. to 12s. 6d.; coking smalls, 10s. to 10s. 6d. per ton. Derbyshire and Nottinghamshire—Top hards, 17s. 3d. to 18s. 9d.; washed doubles, 16s. 3d.; washed singles, 15s. 3d. to 15s. 6d.; washed smalls, 11s. to 11s. 6d.; rough slack, 10s. to 10s. 6d. per ton. Yorkshire, Derbyshire, and Nottinghamshire—Screened steam coal, 15s. to 15s. 3d.; gas coke, 19s. 6d. to 20s. 9d.; furnace coke, 18s. 6d. to 19s. per ton.

Quotations in Lancashire: Lancashire best house coal, 30s. to 33s.; seconds, 28s. to 30s.; common, 19s. to 21s.; kitchen, 22s. to 24s.; Yorkshire Haigh Moor best house, 30s. to 33s.; house, 28s. to 30s.; cobbles, 19s. to 20s.; washed doubles, 13s. to 14s.; washed singles, 12s. to 13s.; rough slack, 8s. to 10s. in wagons at the pit.

MIDLANDS.

It is significant of the condition of the market that no steps have been taken towards raising pithead quotations this month. To all intents the market is as unresponsive as it was in August. Usually the householders' demand for winter supplies begins to make itself felt in the opening weeks of September. It may be that the transient spurt in this branch during July has taken the edge off the market. In any case there is no urgency to take advantage of the low summer prices which still rule, but which cannot be expected to continue much longer.

Industrial consumers are buying only against immediate requirements. These are on a small scale; there being no convincing evidence of any expansion. The prevailing apathy is reflected by irregular working at the pits. Steams are offered at very low rates by Leicestershire collieries. The minimum is about 11s. In other districts quotations range up to 15s. Market equilibrium is still disturbed by pressure to clear slacks and smalls irrespective of price. Spot lots of fine slack can be bought at 6s., and good rough grades change hands at a shilling or two more. Similarly beans have been disposed of at 8s. upwards, and D.S. nuts from about 9s. 6d. up.

Hard furnace cokes remain in plentiful supply at 12s. 6d. to 13s. 6d. at the ovens. At Birmingham, gas coke is 27s. 6d. at the works, 34s. in carts, and 36s. bags, delivered.

TRADE NOTES.

Aluminium Sheet, Strip, and Circles.

A useful set of aluminium data sheets has been forwarded by the British Aluminium Company, Ltd., of Adelaide House, King William Street, London, E.C. 4.

Vaughan Cranes.

The Vaughan Crane Company, Ltd., of Openshaw, Manchester, have prepared a folder illustrating installations of their cranes in connection with various industrial operations—among them being gas-works.

CONTRACTS OPEN.

Coal.

The Gas Committee of the Marple Urban District Council are inviting tenders for the supply of gas nuts, peas, and slack. [See advert. on p. 637.]

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

LONDON, *Sept.* 12.

Tar products continue steady, and values generally are unchanged, as under:

Pitch, 92s. 6d. to 95s. per ton; creosote, about 8¾d. per gallon; pure benzole, 1s. 5d. to 1s. 6d. per gallon; pure toluole, 2s. per gallon; 95/160 solvent naphtha, 1s. 3d. to 1s. 4d. per gallon; and pyridine bases, 6s. to 6s. 6d. per gallon.

Tar Products in the Provinces.

Sept. 12.

Markets for tar products continue firm.

In pitch a few Continental orders have been placed at slightly under market prices quoted on this side.

Creosote remains steady, and business is reported to have been done to the end of March next at round about to-day's prices.

Tar acids generally are still firm.

Crude carbolic is particularly active.

There is not so much demand for cresylics for forward delivery.

The average prices of gas-works products during the week were: Gas-works tar, 64s. 9d. to 69s. 9d. Pitch—East Coast, 88s. 9d. to 91s. 3d. f.o.b. West Coast—Manchester, 83s. 9d. to 86s. 3d.; Liverpool, 86s. 3d. to 88s. 9d.; Clyde, 87s. 3d. to 90s. 3d. Benzole, 90 p.ct., North. 1s. 2d. to 1s. 3d.; crude, 65 p.ct. at 120° C., 10¼d. to 10½d., naked at makers' works; 50/90 p.ct. naked, North, 1s. 3d. to 1s. 4d. Toluole, naked, North, 1s. 4d. to 1s. 5d. nominal. Coal-tar crude naphtha, in bulk, North, 7¼d. to 8d. Solvent naphtha, naked, North, 8¼d. to 9¼d. Heavy naphtha, North, 10d. to 1s. Creosote, in bulk, North, liquid, 7¼d. to 7⅝d.; salty, 7⅜d. to 7¼d.; Scotland, 7¼d. to 7⅝d. Heavy oils, in bulk, North, 8¾d. to 9¼d. Carbolic acid, 60 p.ct., 2s. 6d. to 2s. 7d. prompt. Naphthalene, £11 to £14; salts, £5 to £5 10s., bags included. Anthracene, "A" quality, 2½d. per minimum 40 p.ct., purely nominal; "B" quality, unsaleable.

Extensions at Teignmouth.—The Teignmouth Urban District Council, at their September meeting, decided to invite tenders for the erection of an additional gasholder on land adjoining the existing holder, a new condenser, a washer scrubber, a meter, a boiler, and for the laying of a 14-in. gas main at the works, in place of the one now existing.

Wireless Aerial Attached to a Gasholder.—The question of whether a wireless aerial attached to a gasholder is dangerous was raised at a meeting of the Coalville Urban Council. The Gas Manager has an aerial from his house attached to the holder at the gas-works, and said it was not dangerous. Members of the Council agreed; but to remove any public apprehension, the Manager undertook to disconnect the aerial.

Guildford Gas Light and Coke Company.—The sale of gas by the Company during the half-year ended June 30 was 201 million c.ft., or 14·3 p.ct., over that of the corresponding period of last year. The Directors report that the balance standing to the credit of the profit and loss account, including the amount brought forward, is £15,994; and out of this they recommend the payment of the preference stock dividend, and a dividend on the consolidated ordinary stock at the rate of 7 p.ct. per annum, less income-tax. This will leave £10,752 to be carried forward. The extension of the Company's mains has been completed as far as Gomshall, which is the boundary of the area of supply in that direction. The Directors propose to reduce the price of gas as from the 30th inst. by 3d. per therm, or 2·7d. per 1000 c.ft., to all consumers.

East Hull Gas Company's Stock Issue.—The Directors of the East Hull Gas Company are inviting tenders for £30,000 of 5 p.ct. maximum ordinary stock; the minimum price of issue being £80 per £100 of stock. Tenders must be received not later than 12 o'clock noon on Saturday, Sept. 24, by the Secretary of the Company, St. Mark Street, Hull. The Company was established in 1846 and incorporated by Special Act of Parliament in 1867 as the Sutton, Southcoates, and Drypool Gas Company. Subsequently the name was changed to the East Hull Gas Company. The rapidly developing area of the Company comprises that portion of the City of Hull east of the River Hull and the parish of Sutton. By an Order this year, the Company are empowered also to supply the rural parishes of Wawne, Swine, Thirtleby, Ganstead, Coniston, Bilton, Wyton, and Sproatley. The Company have, by agreement with the New Hedon Gas and Coke Company, Ltd., whose area of supply adjoins that of the Company, applied to the Board of Trade for an Order to confirm the purchase of that Company's undertaking which supplies the borough and parish of Hedon and the parish of Preston, and has power also to supply the parish of Paull. Since incorporation in 1867, the Company have paid each year the maximum dividend allowed by their Acts of Parliament. The quantity of gas sold during the year 1926 was 2,205,706 therms (490,156,900 c.ft.), which was an increase of over 13 p.ct. on the sales of the previous year, and of over 34 p.ct. on the sales in 1921, when the last issue of capital was made. This issue is to provide for capital already expended in excess of the paid-up capital of the Company.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official Journal" for Sept. 7.]

Nos. 22,602—23,203.

BRITISH BRASS FITTINGS, LTD.—"Gas taps." No. 22,723.

BROADHEAD, R. W., and BROADHEAD CONSTRUCTIONS, LTD.—"Gas purifiers, &c." No. 22,759.

DAVIS, R. H. & R. W. G.—"Indicating exhaustion of gas-purifying substances." No. 22,909.

ELECTROLUX, LTD.—"Cutting off gas pipes." No. 23,080.

GASMESSERFABRIK MAINZ ELSTER & CO.—"Coin freed apparatus." No. 23,125.

GORZ, L. HAAS-.—See Gasmesserfabrik Mainz Elster & Co. No. 23,125.

HAAS, P.—See Gasmesserfabrik Mainz Elster & Co. No. 23,125.

I. G. FARBENINDUSTRIE AKT.-GES.—"Production of gases rich in olefines." No. 23,017.

I. G. FARBENINDUSTRIE AKT.-GES.—"Recovery of soluble products from coal." No. 23,018.

KIRKHAM, HULETT, & CHANDLER, LTD.—"Drying gases." No. 23,183.

KNAUER, A. M.—See Gasmesserfabrik Mainz Elster & Co. No. 23,125.

KNOWLES, F. H.—See Kirkham, Hulett, & Chandler, Ltd. No. 23,183.

MASCHINENFABRIK AUGSBURG-NURNBERG AKT.-GES.—"Gasometers." No. 22,893.

ROSLING, C. G.—See Davis, R. H. & R. W. G. No. 22,909.

SPERRYN, G. N.—See British Brass Fittings, Ltd. No. 22,723.

Ideal Homes Exhibition at Bradford.—The Bradford Corporation Gas Committee have authorized the Gas Department to take part in an Ideal Homes Exhibition to be held at Bradford from Feb. 28 to March 10 next year.

Gas Light and Coke Company's Further Reduction.—The Directors of the Gas Light and Coke Company announce a further reduction in the price of gas of 0·4d. per therm, or 2d. per 1000 c.ft. This reduction will take effect as from the reading of the meters during the current month.

Results at Oldbury.—Though the total income for the year of the Oldbury gas undertaking was £4763 more than last year, the accounts show a net loss of £3834 compared with a net profit of £188 last year. This, it was stated at the meeting of the District Council, was due to industrial troubles.

Price of Gas at Aldershot.—We understand that an official announcement will be made at an early date by the Aldershot Gas, Water, and District Lighting Company intimating a further reduction in the price of gas of 1d. per therm from Christmas next. This reduction, with that of 0·8d. per therm at Midsummer, represents nearly 10d. per 1000 c.ft.

Ilkley and the Addingham Gas-Works.—The Ilkley Urban District Council have agreed to acquire the undertaking of the Addingham Gas Light Company, Ltd., for the price of £1120, conditional upon the Council obtaining statutory authority to do so, and to supply gas in Addingham. Mr. F. Sugden said they had met the Gas Company generously; and at the same time they were hopeful of excellent results so far as the Ilkley Council were concerned. Mr. G. Mott (Chairman of the Ilkley Gas Committee) stated that both parties to the negotiation had thought the scheme the best in the interests of the consumers. Ilkley would be able to supply gas at a much cheaper rate than the Addingham consumers were now paying; but the proposals were yet at too early a stage to give exact figures.

Continental Union Gas Company, Ltd.—In their report for the year ended June 30 last, the Directors state that encouraging progress on the part of the French undertaking with which the Company are closely connected can be reported; but the fluctuations of the French Exchange have again prevented the reflection of the better operating results in the revenue account of the year. Though remittances of dividends and interest from France show an increase in francs of nearly 22 p.ct. on last year's figures, the benefit of this increase has been more than negatived by the losses suffered on Exchange. After deducting management expenses and pension charges, and transferring £3000 to Exchange reserve account (the same amount as last year), the balance at the credit of profit and loss account at the close of the year, including £2091 brought forward, was £18,888. Out of this balance there has been paid an interim dividend on the preference stock of 3½ p.ct., less income-tax, for the half-year to Dec. 31, 1926; and the Directors recommend the payment of a final dividend on the same stock at the same rate, less income-tax, for the half-year to June 30, making 7 p.ct. for the year. They also recommend a distribution of 1 p.ct., less income-tax, on the ordinary stock for the year to June 30. This will leave a balance to be carried forward of £1288.

Despite the strong recommendation of the local Council to embark on electric lighting, the parishioners of Branston, Burton-on-Trent, have by a big majority turned down the scheme.

Mr. W. G. Rook, Manager of the Torrington Gas Company, attended a meeting of the Torrington Board of Guardians to furnish information to the members as to the cost of substituting gas illumination for the oil lamps now in use. He said the cost of installation would be about £80, and the charge for gas consumption, at 6s. 9d. per 1000 c.ft., should not amount to more than £40 a year.

STOCK MARKET REPORT.

As was anticipated, the new account started well on the Stock Exchange last week; business in the Industrial Market being the dominant feature. Conditions elsewhere were quiet; but gilt-edged securities were affected by the unexpected Treasury Bond offer. The terms of the issue, 4½ p.ct. at the minimum price of £99 6s., caused considerable uncertainty as to the effect on the proposed new 3½ p.ct. Conversion Loan offer to holders of the 3½ p.ct. War Loan and National War Bonds due for repayment next year. Prices weakened at first, but recovered subsequently.

All classes of securities participated in the activity in the Industrial Market. The improvement is attributed to the more settled labour conditions and anticipation of more satisfactory accounts for the current year. Speculation is rife, however, and it is possible that liquidation by genuine investors will bring about a reaction.

Gas Stocks continued to be well supported.

Issue.	Share.	When ex-Dividend.	Dividends. Prev. Hf.Yr	Dividends. Last Hf. Yr.	NAME.	Quotations. Sept. 9.	Rise or Fall on Week.	Transactions. Lowest and Highest Prices.
£			% p.a.	% p.a.				
171,978	Stk.	Feb. 10	5	5	Aldershot 5 p.c. max. C. .	68—73*	−1	..
322,992	,,	,,	4	4	Do. 4 p.c. Pref. . .	67—70*	−1	..
1,461,868	,,	Apl. 7	6½	7	Alliance & Dublin Ord. .	84—87	..	84⅜
274,000	,,	July 14	4	4	Do. 4 p.c. Deb. . .	64—67	..	..
532,654	,,	Aug. 15	—	7	Barnet Ord. 7 p.c. . . .	101—104	..	..
800,000	1	Apl. 28	1/7½	1/7½	Bombay, Ltd.	1 7/16—1 7/16	+ 1/16	22/9—22/10½
170,000	10	Aug 25	8½	8½	Bournemouth 5 p.c. . . .	12½—13½	..	..
500,050	10	,,	7	7	Do. B 7 p.c. . . .	12—12½	..	12⅜
275,000	10	,,	6	6	Do. Pref. 6 p.c. .	10⅜—11½	..	11½
50,000	Stk.	June 29	3	3	Do. 3 p.c. Deb. .	54—57	..	..
163,025	,,	,,	4	4	Do. 4 p.c. Deb. .	74—77	..	..
267,900	,,	Aug. 25	—	7½	Brighton & Hove 6 p.c. Con.	102—105	..	..
341,800	,,	,,	—	6/8/6⅔	Do. 5 p.c. Con.	92—95	..	..
1,387,500	,,	July 28	5	5	Bristol 5 p.c. max. . . .	84—85a	..	..
485,000	,,	Mar. 24	8	7	British Ord.	108—111	..	..
100,000	,,	June 29	7	7	Do. 7 p.c. Pref. . .	112—117	..	..
130,900	,,	,,	4	4	Do. 4 p.c. Red. Deb. .	73—78	..	..
200,000	,,	,,	—	88/2	Do. 5 p.c. Red. Deb.	94—96	..	..
100,000	10	May 26	6	8	Cape Town, Ltd. . . .	7½—8½	..	..
100,000	10	Apl. 28	4½	4½	Do. 4½ p.c. Pref. . .	6—7	..	..
150,000	Stk.	June 29	4½	4½	Do. 4½ p.c. Deb. . .	70—75	..	..
898,860	,,	July 24	6	6	Cardiff Con. Ord. . . .	97—100	..	..
837,860	,,	June 29	7½	7½	Do. 7½ p.c. Red. Deb. .	99—102	..	..
157,150	,,	Aug 11	6½	5	Chester 5 p.c. Ord. . . .	87—92b	..	..
79,185	1	Apl. 28	12/-	12/-	Colombo Ltd. Ord. . . .	29/—31/-	..	..
34,495	1	,,	1/4½	1/4½	Do. 7 p.c. Pref. .	20/—22/-	..	..
331,490	1	Apl. 7	1/9⅜	1/9⅜	Colonial Gas Assn. Ld. Ord.	25/—27/-	..	..
178,900	1	,,	1/7½	1/7½	Do. 8 p.c. Pref.	20/—22/-	..	..
2,073,280	Stk.	July 14	—	5	Commercial Ord. . . .	86½—88½	..	87—88
475,000	,,	June 16	3	3	Do 3 p.c. Deb. .	56—59	..	53
309,000	,,	Sept. 30	‡2	‡1	Continental Union, Ltd. .	34—26	−1	33
200,000	,,	Mar. 10	7	7	Do. 7 p.c. Pref. .	84—86	..	..
787,560	,,	Aug. 11	6½	6½	Croydon sliding scale . .	96—99	..	97¼—98
408,100	,,	,,	5	5	Do. max. div. . . .	77—80	..	78—79½
402,270	,,	Aug. 25	9	6	Derby Con.	103—105c	..	..
55,000	,,	June 29	4	4	Do. Deb.	73—75c	..	..
309,000	,,	Aug. 25	5	5	East Hull Ord. 5 p.c. . .	78—81	+2	78
50,000	,,	June 16	5	5	Eastbourne 5 p.c. Deb. .	90—95	..	..
1,002,180	10	Mar. 24	‡3	‡3	European, Ltd.	6½ 7	+½	6 5/16—6⅜
18,747,460	Stk.	July 28	5	5	Gas Light & Coke 4 p.c. Ord.	86—88	..	86⅝—87½
2,400,000	,,	,,	3½	3½	Do. 3½ p.c. max. . .	59—61	..	60 - 60⅝
4,157,020	,,	,,	4	4	Do. 4 p.c. Con. Pref. .	74½—76½	..	75½—76
5,602,620	,,	June 16	3	3	Do. 3 p.c. Con. Deb. .	58—60	..	53½
181,315	,,	,,	6	6	Do. 6 p.c. Br'tf'd Rd. Db.	100—103	..	..
1,642,770	,,	,,	5	5	Do. 5 p.c. Red. Deb. .	98—100	..	..
42,000	,,	—	7½	7½	Do. 7½ p.c. Ilford Deb. .	..	..	..
22,500	,,	Aug. 25	6⅔	6⅔	Hastings & St L. 5 p.c. Conv.	89—91	..	..
358,740	,,	,,	5⅔	5⅔	Do. 3½ p.c. Conv.	66 - 69	..	..
70,000	10	Apl. 28	†10	†10	Hongkong & China, Ltd. .	12—18	..	..
172,300	Stk.	Aug 25	5	5	Hornsey Con. 5½ p.c.	65—68	..	..
1,476,000	,,	May 12	10	10	Imperial Continental Cap.	139—141	..	139—141
223,130	,,	Aug. 11	3½	3½	Do. 3½ p.c. Red. Deb.	68—70	..	..
235,242	,,	Aug. 11	6½	7	Lea Bridge 5 p.c. Ord. . .	94—97	..	..
2,145,907	,,	Aug. 11	5½	5½	Liverpool 5 p.c. Ord. . .	84—85	..	..
600,000	,,	Sept. 30	7	7	Do. 7 p.c. Red. Pref.	103—105b	..	..
105,736	,,	Aug. 25	8	9	Maidstone 5 p.c. Cap. . .	107—112	..	..
93,480	,,	June 16	3	3	Do. 3 p.c. Deb. . .	50—55	..	..
75,000	5	June 16	†7	†8	Malta & Mediterranean .	5—5½	..	..
641,930	Stk.	May 26	†5	†7	Montevideo, Ltd. . . .	90—92	..	..
2,081,815	,,	July 28	5	5	Newcastle & Gateshead Con.	74—75d	..	74 13/16
260,999	,,	,,	4	4	Do. 4 p.c. Pref. .	67½—68½d	..	..
691,705	,,	June 29	8½	8½	Do. 8½ p.c. Deb. .	66½—67½d	..	..
131,785	,,	Aug. 25	—	6/18.0	North Middlesex 6 p.c. Con.	90—93	..	..
200,000	,,	Apl. 28	9	7	Oriental, Ltd.	100—102	..	..
188,120	,,	June 29	7½	7½	Plym'th & Ston'house 5 p.c.	102—107	..	..
414,500	,,	Aug. 25	7½	7½	Portsm'thCon.Stk.4p.c.Std.	102—105	..	..
326,782	,,	,,	5	5	Do. 5 p.c. max.	76—79	..	..
2,289,909	1	—	—	—	Primitiva Ord.	16/6—17/6	..	16/9—17/3
283,200	100	June 1	4	4	Do. 4 p.c. Red. Deb. .	84—86	..	..
600,000	Stk.	July 28	4	4	Do. 4 p.c. Red. Deb. 1911	71—73	..	..
434,963	,,	June 29	—	4	Do. 4 p.c. Cons. Deb. . .	71—73	..	73—73½
150,000	10	Mar. 24	6	6	San Paulo 6 p.c. Pref. . .	7½—7¾	..	..
195,000	50	June 29	5	5	Do. 5 p.c. Red. Deb.	46—49	..	48½
370,000	Stk.	Mar. 24	5⅔	5⅔	Sheffield A	102—104c	..	..
419,968	,,	,,	5⅔	5⅔	Do. B	102—104c	..	..
1,047,000	,,	,,	5⅔	5⅔	Do. C	102—104c	..	..
90,000	10	May 26	4	6	South African	4—6	..	..
6,809,886	Stk.	Aug. 11	7	6	South Met. Ord.	101½—103½	..	102—103
500,000	,,	,,	—	—	Do. 6 p.c. Irred. Pf.	109—112	..	110½—110⅝
1,895,445	,,	July 14	3	3	Do. 3 p.c. Deb. . .	57—60	+1	58½—59½
734,000	,,	Mar. 10	6½	6½	Do. 6½ p.c. Red. Db.	100—102*	−2	..
91,500	,,	Aug. 11	8½	8½	South Shields Con. . . .	101—103d	..	..
1,343,795	,,	July 28	6½	6½	South Suburban Ord. 5 p.c.	102—105	..	104½
868,837	,,	June 16	5	5	Do. 5 p.c. Deb.	92—95	..	..
847,740	,,	Mar. 24	5	5	South'mpton Ord. 5 p.c. max	73—76*	−1	77½
151,275	,,	June 29	4	4	Do. 4 p.c. Deb.	71—74	..	71½
250,000	,,	Aug. 25	7	7	Swansea 7 p.c. Red. Pref. .	100—102	..	..
200,000	,,	June 16	6½	6½	Do. 6½ p.c. Red. Deb.	100—102	..	..
130,000	,,	July 28	7½	7½	Tottenham District A 5 p.c.	105—108	..	..
663,275	,,	,,	6½	6½	Do. B 5½ p.c.	89—92	..	..
150,000	,,	,,	6½	6½	Do. 5½ p.c. Pref.	95—98	..	..
181,255	,,	June 16	4	4	Do. 4 p.c. Deb.	70—73	..	..
258,251	,,	Mar. 10	5	5	Tynemouth Con. and New Uxbridge, Maidenhead, &	73½—74½d	..	..
293,094	,,	Aug. 25	6½	6½	Wycombe 5 p.c. . . .	85—90	..	..
88,880	,,	,,	5	5	Do. 5 p.c. pref. .	83—88	..	84
30,000	,,	July 14	8½	8½	Wandsworth, Wimbledon, and Epsom— Wandsworth A 5 p.c. .	117—122	..	..
325,686	,,	,,	7	7	Do. B 5½ p.c. .	100—105	..	103
483,585	,,	,,	5/19/0	5/19/0	Do. C and New	88—93	..	..
863,000	,,	,,	6⅔	6⅔	Do. Wimbledon 5 p.c. .	98—103	..	..
98,000	,,	,,	7½	7½	Do. Epsom 5 p.c. . .	100—105	..	..
200,000	,,	,,	5	5	Do. 5 p.c. Pref . . .	83—88	..	..
88,415	,,	June 29	3	3	Do. 3 p.c. Deb. . . .	52—56	..	..
284,742	,,	,,	4	4	Do. 4 p.c. Deb. . . .	73—76	..	..

Quotations at:—a.—Bristol. b.—Liverpool. c.—Nottingham. d.—Newcastle e.—Sheffield. * Ex. div. † Paid free of income-tax. ‡ For year.

An announcement of interest is the proposed amalgamation of the Tynemouth Gas Company with the Newcastle-upon-Tyne Gas Company. Under the scheme, the Tynemouth stockholders are to receive, for each £100 of stock, £125 of the Newcastle Company's 4½ p.ct. preference stock, and holders of 4½ p.ct. preference stock in the Tynemouth Company are to receive an equal amount of Newcastle 4½ p.ct. preference stock. The Newcastle Company will take over the mortgages of the Tynemouth Company. Statutory authority must, of course, be obtained. The report of the Continental Union Gas Company shows a slightly reduced balance of profit for the year to June. A dividend of 1 p.ct. per annum, being the same rate as for the previous year, is recommended.

The following transactions were recorded during the week:

On Monday, Commercial 87, 3 p.ct. debenture 58, Continental Union 33, European 6 5/16, 6⅜, Gas Light and Coke 86⅜, 87, 87⅛, 87⅜, 4 p.ct. preference 76, 3 p.ct. debenture 59½, Imperial Continental 140, 141, Primitiva 16s. 9d., 16s. 10½d., 17s. 1½d., 17s. 3d., South Metropolitan 102, 102⅛, 6 p.ct. preference 110½, 110⅜, 3 p.ct. debenture 58⅜, Southampton 5 p.ct. 77½, 4 p.ct. debenture 71½, Uxbridge 5 p.ct. preference 84, Wandsworth "B" 103. Supplementary prices, Redhill 81½, 82, 6 p.ct. preference 98, 98½.

On Tuesday, Alliance and Dublin 84⅜, Bournemouth 6 p.ct. preference 11½ *ex* div., Commercial 88, Continental Union 33, Croydon sliding-scale 97½, 98, maximum dividend 78, Gas Light and Coke 4 p.ct. preference 75⅝, Imperial Continental 140, 141, Liverpool 7 p.ct. preference 104½, Primitiva 16s. 10½d., 17s. 1½d., South Metropolitan 102⅜.

On Wednesday, Bombay 22s. 9d., 22s. 10½d., Bournemouth "B" 12⅜, Commercial 87½, Croydon maximum dividend 79½, East Hull 5 p.ct. maximum 78, Gas Light and Coke 86½, 87, 87½, 3½ p.ct. maximum 60⅜, 60½, 60⅝, 4 p.ct. preference 76, Imperial Continental 139, Primitiva 16s. 9d., 16s. 10½d., 17s., 17s. 1½d., South Metropolitan 102, 102¼, 6 p.ct. preference 110¼, 3 p.ct. debenture 59½.

On Thursday, Commercial 88, Continental Union 33, European £6 8s. 6d., Gas Light and Coke 86⅜, 87, 87⅛, 87⅜, 3½ p.ct. maximum 60, 4 p.ct. preference 76, Imperial Continental 141, Liverpool 7 p.ct. preference 104½, Primitiva 16s. 9d., 17s., 17s. 1½d., San Paulo 5 p.ct. debentures 48½, South Metropolitan 103, 6 p.ct. preference 110⅜, South Suburban 5 p.ct. 104½. Supplementary prices, Aldershot 7 p.ct. Bonds 101½, Bournemouth 7 p.ct. debenture 102½, 103½, Liverpool 5 p.ct. 83½, Southend-on-Sea 4 p.ct. debenture 70, 70½.

On Friday, Bombay 22s. 9d., European 6 5/16, 6 11/16, 6 23/32, 6¾, Gas Light and Coke 86⅞, 87, 87⅛, 87½, 4 p.ct. preference 75½, 75⅝, Newcastle and Gateshead 3½ p.ct. standard 74 13/16, Primitiva 16s. 9d., 4 p.ct. cons. deb. 72, 72⅜, South Metropolitan 102½, 102¼, 102½, 102⅜, 3 p.ct. debenture 58½. Supplementary prices, Derby 5 p.ct. standard 103, Liverpool 5 p.ct. standard 84½, Swansea 5 p.ct. maximum 80½, Ventnor 16⅜.

The usual easier monetary conditions prevailed in Lombard Street at the end of the week. There was a good demand, and the charge for new money opened at 3½ p.ct., but quickly declined to 3⅛ p.ct., the same rate being charged for old day-to-day loans. Treasury Bills were allotted at £4 6s. 10·76d. p.ct.—being 8·06d. p.ct. above the previous week's rate—and imparted a firm tone in the discount market.

The Foreign Exchange Market was on the quiet side, and rates moved narrowly. Sterling on New York closed at $4.86 7/32. French francs were steady at 124, forward quotations being slightly firmer. Italian lire eased to 89 7/16, and the Belgian rate appreciated to 34.91. Spanish pesetas were inactive at 28.82½, and the Dutch rate hardened to 12.13⅜.

Silver again advanced; both cash and forward quotations being 25 5/16d. per oz. Gold was unaltered at 84s. 11½d. per oz.

The Bank Rate is 4½ p.ct., to which it was reduced from 5 p.ct. on April 21. The Banks' deposit rate is 2½ p.ct., and the deposit rates of the discount houses are 2½ p.ct. at call and 2¾ p.ct. at notice.

NOTICES TO CORRESPONDENTS, ADVERTISERS, AND SUBSCRIBERS.

No notice can be taken of anonymous communications. Whatever is intended for insertion in the "JOURNAL" must be authenticated by the name and address of the writer—not necessarily for publication, but as a proof of good faith.

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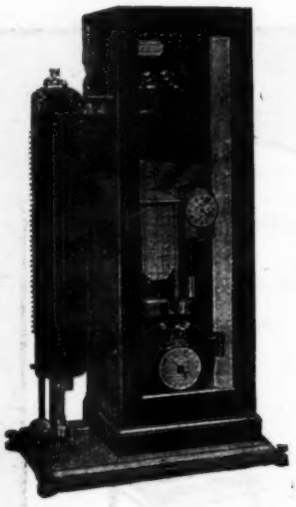

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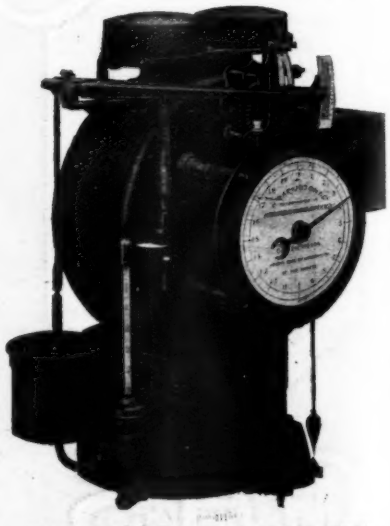

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